

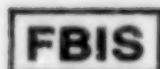
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1 May 1980

USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 63



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1 May 1980

USSR REPORT
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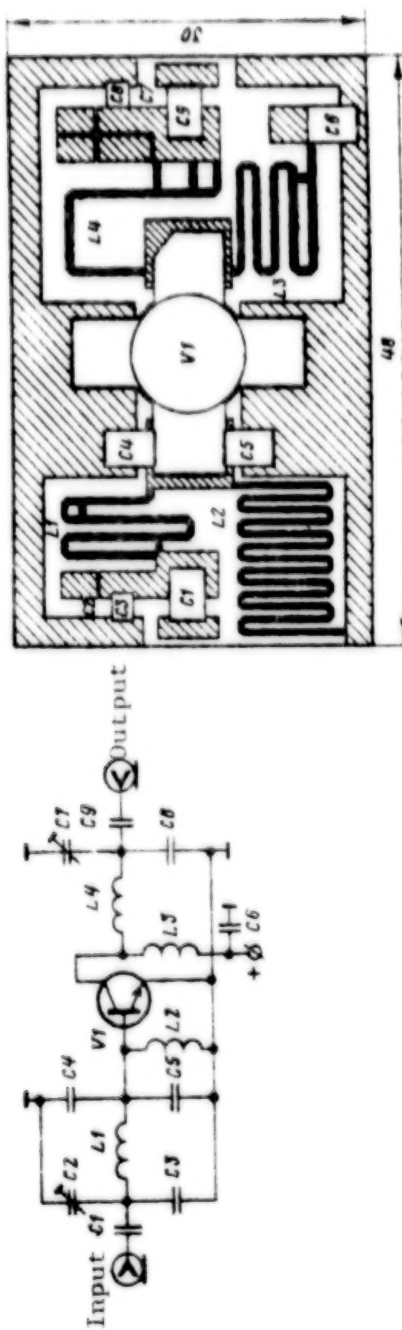
WIDE-BAND AMPLIFIER MODULES BASED ON KT934B AND KT934V TRANSISTORS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 91-93 manuscript received 23 May 78

IVLEV, B. I., Novosibirsk Electrical Engineering Institute

[Abstract] Wide-band microwave amplifiers based on KT934B and KT934V transistors are described. The schematic diagram and topological layout of the amplifier modules are shown in the figure. The amplifiers are made on ceramic plates measuring 48 x 30 x 1 mm with elements in the form of lumped capacitors C1, C3-C6, C8, C9 (type K21-9-11v), structural trimmer capacitors C2 and C7, and inductances L1-L4 made of equivalent sections of asymmetric microstrip lines. The amplifiers have an output power of 20 W in the frequency band of 160-450 MHz with working bandwidth of 100-150 MHz. Power gain is 6-11 dB and efficiency is greater than 52 percent. The amplifiers are made as thin-film hybrid integrated circuits. Figures 2; tables 2; references 3: 2 Russian, 1 Western.

[136-6610]



USSR

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AUTOMATIC RECEPTION AND STORAGE OF INFORMATION FROM AN EXPERIMENTAL
FACILITY FOR STUDYING COSMIC RAYS WITH SIMULTANEOUS ANALYSIS ON THE
NAIRI-2 COMPUTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 58-63 first version received 11 Feb 77; received 28 Feb 79

AVAKYAN, V. V., BAGDASARYAN, L. S., VASINYUK, I. YE., VINNITSKIY, O. M.,
KAZARYAN, S. P., OGANEZOVA, DZH. S. and OGANESYAN, A. G., Yerevan Physics
Institute

[Abstract] The investigation of cosmic rays requires a high-transmission facility with a large number of elementary particle detectors. To accelerate processing of large amounts of data and improve the precision of recording events, the authors have developed a system for automatic gathering of information from all detectors with simultaneous data reduction on the Nairi-2 computer. This system receives and processes data from 288 filaments of coordinate proportional counters, 108 filaments of amplitude proportional chambers and 284 ionization chambers. The schematics of the main units of the facility are explained: the control module and separator, the master clock and synchronizer, and the ionization chamber commutator. The authors thank S. G. Matinyan and E. A. Mamidzhanyan for continued interest and active participation in the work, G. Ya. Bashindzhagyan and N. S. Sinev for assistance in the installation and alignment, and also G. S. Karapetyan for operational assistance in starting the Nairi-2 computer and other devices. Figures 8; references 4: 3 Russian; 1 Western.
[136-6610]

USSR

UDC 62-50:62-501.7.088

METHODS OF NONSIMULTANEOUS AND PERIODIC CONVERSION OF SIGNALS IN
AUTOMATIC CONTROL SYSTEMS

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 7, Jul 79
pp 23-28 manuscript received 11 Jul 78

SKRIPNIK, YU. A. and KREPYSHEV, G. B., Kiev Technological Institute of
Light Industry and Ural Electromechanical Institute of Railway Transport
Engineers Chelyabinsk Branch

[Abstract] A demonstration is given of the fact that the nonsimultaneous and periodic conversion of signals in an automatic control system employing feedback makes it possible to separate the error signal and to achieve the effect of compensating the signal and parametric noise influencing

the system. In automatic control systems employing feedback, for the purpose of arriving at the error signal a determination is made of the difference between the sum of the input signal and the feedback signal, and an adjustment is made to the extent of the determined value of the error signal, which is preferably zero. Signals caused by external and internal signals and parametric noise are added to the continuous or discrete error signal passing through the system and the controlled system reacts to the total error signal. Since the spectra of the useful component of the error signal and of the signal and parametric noise are generally not separated, it is impossible to isolate the useful component of the error signal. Because of drift in the parameters of the system's elements over time and because of temperature and other factors, the disturbances influencing the system have an effect on the error and result in worsening of accuracy and reliability. Methods of nonsimultaneous and periodic conversion of signals are shown to have advantages from the viewpoint of combating parametric and signal noise in systems employing feedback. In nonsimultaneous conversion, the system's input signal and the feedback signal are fed to the system's input and pass practically through the same loop with the same parameters, the influence of parametric and signal noise is eliminated with an accuracy equal to the error in the nonsimultaneity of conversion. The influence of parametric and signal noise on the system's accuracy is lessened in proportion to the reduction in the time between conversion of the input signal and feedback signal. The error in the system is characterized by a signal representing the difference, in the output of elements of the forward loop, in signals characterizing the converted input signal and feedback signal. A memory unit is employed for the purpose of determining the difference in the converted signals. In periodic conversion, the input signal and feedback signal are fed to the system's input and pass through elements of the system's forward loop in turn periodically. When the input signal and feedback signal are not equal, in the system's circuit, at the frequency of periodic conversion, a periodic signal appears made up of segments of the input signal and feedback signal. Depending on the information parameters of the input signal and feedback signal, the signal in the system's circuit is in the form of an amplitude-, phase- or frequency-modulated signal whose envelope is the system's error signal. This signal in passing through the system's circuit is converted by elements of the system and is subjected to the influence of signal and parametric noise. By utilizing the difference arrived at between the spectral characteristics of the useful component of the error signal and the parametric and signal noise it is possible with a filter to isolate the useful component of the signal at the frequency of periodic conversion and to adjust to zero the isolated modulation component. Another filter is used to isolate the slowly varying component of the signal in the system's circuit to characterize the drift of parameters of elements and the external disturbances and noise in this section of the system. It is possible to use this component for automatically adjusting the system's parameters and compensating the effect of disturbances and noise. A

discussion is presented of the implementation of a system featuring periodic conversion of a quasi-stationary input signal and feedback signal. This system is discussed theoretically. Also discussed is the case of nonsimultaneous conversion of signals. It is demonstrated that with the nonsimultaneous and periodic conversion of signals the feedback method can be employed also for systems in which the error signal is determined by comparing incoherent radiation, heat flux, and hydraulic and pneumatic signals. The nonsimultaneous and periodic conversion methods make it possible to switch these quantities, i. e., to feed them to the system's input nonsimultaneously or periodically and to separate the error signal. This results in dispensing with the necessity of converting these quantities into other signals and with the resulting complication of equipment required. As an example of a system employing periodic conversion of the input and feedback signals a system is discussed for automatically regulating the temperature of a heated surface. An input photocell is exposed on one side to the heated surface and on the other to an incandescent lamp whose temperature varies according to a program. The slits through which the light flux strikes the photocell are covered alternately by the oscillating armature of a polarized electromagnet. The light fluxes to be compared pass alternately through a light filter and act on the photocell. If the brightness of the heated surface and incandescent lamp are not equal, at the output of the photocell a variable component of the photocurrent at the operating frequency of the photocell appears, and the amplitude of this component is proportional to the difference in the light fluxes. This variable component is fed to an a.c. amplifier and then to a correction circuit and actuator which by means of a damper controls the supply of energy to the heated surface. To this actuator is supplied a reference voltage at the frequency of the photocell's operation. The paper was recommended by the Department (Kafedra) of Automation and Theoretical Basis of Electrical Engineering. Figures 2; references: 8 Russian. [33-8831]

USSR

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DIGITAL COMPUTER CALCULATION OF DIRECTED GRAPHS OF COMPLEX MAGNETIC CIRCUITS

Minsk IEV.VUZ: ENERGETIKA in Russian No 11, Nov 79 pp 99-103 manuscript received 11 Mar 79

ISMIYEV, E. G., candidate of technical sciences, Azerbaijan Polytechnical Institute imeni Ch. Il'drym

[Abstract] The practical use of digital computers for analysis of complicated magnetic circuits runs up against the difficulty of initial preparation for computer input. The author shows that directed graphs

can simplify this task, and can provide a universal approach to solution of the problem of magnetic circuit analysis. The flowchart of the computer program for calculating the directed graph is compiled by using Mason's formula:

$$T = \frac{1}{\Delta} \sum P_k \Delta_k$$

where T is the transfer of the graph from source x_1 to drain x_j ; P_k is the transfer of the k -th direct path from source x_1 to drain x_j ; Δ_k is the complementary minor of the k -th path, i. e. the determinant of the part of the graph that does not touch the k -th path; $\Delta = 1 - \sum k_1 + 2k_2 - 2k_3 + \dots$ is the determinant of the graph; $\sum k_1$ is the sum of the transfers of all loops of the graph; $\sum k_2$ is the sum of the transfers of all loops of the graph that do not touch each other and are multiplied by pairs; $\sum k_3$ is the same with multiplication by triplets and so on. The designations of the blocks in the flowchart are given and a specific example is shown. The paper is presented by the Department (Kafedra) of Theoretical and Fundamental Electrical Engineering. Figures 3; references 3:
2 Russian; 1 Western.
[162-6610]

USSR

UDC 621.3.078

ONE METHOD OF CONVERTING A DISCRETE RANDOM PROCESS INTO A CONTINUOUS ONE

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian. Vol 22 No 7, Jul 79
pp 3-7 manuscript received 13 Nov 78

YARMOLIK, V. N. and LEUSENKO, A. YE., Minsk Radio Engineering Institute

[Abstract] Equipment which reproduces wideband and bandpass random processes is used to make vibration tests of automation components and equipment. Sometimes used are generators of bandpass random processes whose output process has a spectral power density, $S(\omega)$, with a zero value in a narrow frequency band. One method of producing bandpass processes is to use a digital bandpass filter to whose input is supplied digital white noise. The input readings of the white noise are processed according to the algorithm for the operation of a non-recursive digital filter. The resulting discrete output process has a spectral power density of the bandpass type. An important disadvantage of digital filters is the fact that the frequency response characteristic of a digital filter is a periodic function and the recurrence period is a result of the discrete representation of data. When white noise, representing a random process with a uniform spectrum, is fed to the input of a digital bandpass filter, at its output a process is observed which in addition to the fundamental operating band has recurring (image)

spectral power density bands. Therefore, in order to produce continuous bandpass random processes it is necessary to convert the discrete random process in the output to a continuous one and to suppress images of $S(\omega)$. The employment of low-frequency analog filtering for the purpose of suppressing secondary images of the spectral power density results in the fact that digital filters thereby lose, among others, the advantage of simplicity in retuning to different frequencies. Here in the designing of generators of bandpass random processes, the problem is investigated of finding a conversion function which will simultaneously solve the problem of conversion and the problem of suppressing secondary images. The conversion function is defined as a function which describes the process of converting a discrete reading of the process into a continuous process in the digitization period. The case is considered of employing combined digital-analog filters whose output signal is represented in analog form. A structural diagram is shown of a filter of this type. Readings of the digital white noise are fed to the input of a delay element. When a transmitter of equally probably independent digits is used as the primary source of white noise, readings of this noise are equated to a zero or a one. Discrete readings of the digital white noise are multiplied in multiplication circuits by the conversion function, which is continuous in the range from $-T/2$ to $+T/2$, where T is the digitization period. Values of the white noise modulated further by the conversion function are summed in an operational amplifier with weights proportional to the filter's weighting factor. The form of the conversion function has a considerable influence on the amount of attenuation of extra image bands of the spectral power density. In the example discussed, attenuation of the first image equals 10 dB, as compared with the operating band, which is unacceptable for practical purposes. It is stressed that it is necessary to try to reduce the amount of parasitic responses of filters to an acceptable level. An analytical expression is given for a conversion function which can be employed in simplifying the technical implementation of a generator of random processes employing computer components. From this expression a criterion is derived for optimizing the attenuation of extra images of the generator's frequency response characteristic. Forms of the conversion function which can be employed for different purposes are discussed. It is demonstrated that the employment of the method discussed here of generating random processes on the basis of digital filters employing the conversion functions given makes it possible to preserve all the advantages of digital filters, especially the capability of retuning over a wide range, and also to improve the quality indicators of generators of this sort. The paper was recommended by the Department (Kafedra) of Electronic Computers. Figures 3; references: 5 Russian.

[33-8831]

A SIMPLE ANALOG MEMORY

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 70-71 manuscript received 19 Jun 78

BESHKAREV, A. V. and MARKOVICH, I. I., Taganrog Radio Engineering Institute

[Abstract] A simple analog memory is proposed, designed for operation with a fast-acting analog-digital converter. The unit is open-ended, and contains two buffer amplifiers, an FET switch with control circuit, and a reservoir capacitor. The memory has a sampling time of $\leq 1 \mu s$, storage time of $\geq 1 ms$, maximum input signal frequency of 200 kHz, temperature zero drift of $\leq 70 \mu V/^\circ C$, dynamic input signal range of 48 dB relative to a level of 1 V, coefficient of transmission of 0.955 ± 0.005 , input impedance of $\geq 50 k\Omega$ at 200 kHz, and total error of ≤ 1 percent.

Figures 1; references: 4 Russian.

[136-6610]

A DIGITAL ACCUMULATOR OF MAGNETIC RESONANCE SPECTRA

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
p 183 manuscript received 28 Apr 78

KATUSHONOK, S. S., KOMAR, M. V., KUDALENKIN, V. V., ONISHCHUK, S. G., SHESTAKOVA, L. I. and SHUSHKEVICH, S. S.

[Abstract] While this device is designed chiefly for registration of electron paramagnetic resonance signals, it can be used anywhere that periodic signals are to be isolated from uncorrelated noise. Ten-digit binary code is used to control the useful signal source. This code provides sawtooth scanning with registration on the forward pass. Limits of time regulation 0.1-800 s on forward travel and 10 ms to 4 s on return travel. Data in binary code is stored in a semiconductor memory with capacity of 1024×20 bits. Data can be recorded in all channels or by groups of 512, 256, 138 and 64 channels. The sensitivity threshold of the device is 20 mV. The accumulator is capable of the mathematical operations of differentiation, integration and double integration of the stored data. Results of accumulation and data processing are displayed on a 16LK2B CRT and a coordinate chart recorder. Power consumption is 80 W on 220 V, measurements are $480 \times 240 \times 430$ mm and weight is 35 kg. Figures 1.

[136-6610]

A SEQUENTIAL-TO-GRAY CODE CONVERTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 87-88 manuscript received 25 May 78

GONCHAR, A. I. and TRUBNIKOV, V. R.

[Abstract] A converter is proposed that changes sequential code corresponding to the amplitude of an input signal into Gray code based on the cyclic regularity of the recurrence of ones and zeros in each digital place of the Gray code as there is a sequential change in the number of pulses of the sequential code. Examination of this sequence shows that the frequency of the change in state of the n -th flip-flop of a counter in Gray code corresponds to the frequency of change in the state of the $(n+1)$ -th flip-flop of a binary counter. Hence the sequential code can be converted to Gray code by introducing one flip-flop operating as a counter at the input of the device, and making the appropriate logic connections. A 12-place converter based on this principle in an amplitude-digital converter for 4096 channels reduces the digital component of differential nonlinearity to ± 0.7 percent over 98 percent of the spectrometer measurement range. The proposed converter is made with series 155 ICs, and can handle sequential codes with a pulse recurrence rate of up to 25 MHz. The authors thank V. S. Nesterenko for discussing some versions of the converter. Figures 1; references: 3 Russian. [136-6610]

THE UVI -- A DEVICE FOR EXPERIMENTAL DATA REDUCTION AND INPUT ON THIRD GENERATION COMPUTERS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 165
manuscript received 15 May 78, after revision 1 Sep 78

VASIL'YEV, V. N., DUDALEV, V. P., IVANOV, V. A., SOLODIKHIN, G. M.
and SOLODOVNIKOV, V. A.

[Abstract] A description of a device covered by Soviet Patent No 541162 [see "Otkrytiya, izobreteniya, promyshlennyye obraztsy, tovarnyye znaki," No 48, 1976, p 133]. The UVI is designed for experimental data reduction and input on YeS, ASVT and SM computer systems. The device can receive information from various non-standard sources with digital output by using interchangeable interface boards. There is a built-in frequency-to-code converter for computer input of FM signals. The unit has a printer, a display and a graph plotter. Up to 20 external devices can be connected.

Maximum rate of data input 200 kbytes/s. Maximum frequency of modulation of input signals -- 50 kHz. The device uses 3000 ICs series 133 and 185. Supply voltage 200 V, power consumption 200 W, dimensions 1690 x 900 x 950 mm. Figures 1.
[136-6610]

USSR

UDC 681.327

COMPRESSION OF INFORMATION IN A COMPUTER MEMORY

Leningrad IZV, VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 7, Jul 79
pp 61-65 manuscript received 29 Sep 78

KONON, N. E., PLATONOV, P. I. and SKORUBSKIY, V. I., Pushkino College of Radio Electronics for Air Defense

[Abstract] A method of data compression is discussed which makes it possible to reduce the physical size of a memory without altering its information capacity and which can be used for coding and storing microprograms in permanent memory units with both parallel and parallel-sequential access. Most methods of compressing binary data require multiple transformations and are complicated to implement. The method described here is based on the fact that each successive n -bit word is placed in the memory with a one-bit shift to the right or left in relation to the preceding word. The number of memory elements, m , in this method of storing data is defined by the equation $m_1 = N + (n-1)$, where n is the number of bits in a word and N is the number of words which can be stored in the memory on the condition that maximum compression is possible, where $1 < N \leq 2^n$. With the ordinary method of storage $m_2 = N \cdot n$. The effectiveness of employing compression is characterized by the compression factor, $K = m_2/m_1$, where for maximum compression $K_{\max} = N \cdot n/[N + (n-1)]$. The number of memory elements used in the method suggested is reduced approximately n -fold with the maximum compression of words, N . The allocation of information is cyclic, whereby the preceding number in a sequence is shifted one bit to the right or left and the free bit is filled in with a binary digit, c . The recursion formula for arriving at the next number in a sequence is $x_{i+1} = (2x_i + c_{i+1})$, where x_i is the i -th number in the sequence, c_{i+1} is a binary digit in sequence C and x_0 is a certain n -bit number, where sequence C represents a 2^n -bit combination of zeroes and ones, where $C = c_1c_2c_3 \dots c_n$. The number of possible combinations is 2^{2^n} . A curve is shown for $K_{\max} = f(N)$ for $n = 8$. A structural diagram is given of a dynamic permanent memory unit with direct access to words represented in compressed form by a string of bits. Access time is reduced by means of a complicated decoder which selects words concomitantly with a shift. A structure for a permanent memory unit is suggested for the purpose of simplifying the decoder. This structure provides for parallel access with a matrix

storage. The paper was recommended by the Department (Kafedra) of the Basis of Computer Techniques. Figures 5; references 3: 1 Russian; 2 Western. [33-8831]

USSR

UDC 681.327

THE UPI -- A DEVICE FOR RECORDING MEASUREMENT INFORMATION ON MAGNETIC TAPE STORAGE IN YeS EVM COMPUTERS

Moscow PRIBORY I TEKHNICA EKSPERIMENTA in Russian No 6, Nov/Dec 79
p 164 first version received 15 May 78; received 1 Sep 78

VASIL'YEV, V. N., ZHABYKO, YU. M., KOROBV, YU. A., POPELENSKIY, YU. F., SOLODIKHIN, G. M. and SOLODOVNIKOV, V. A.

[Abstract] A description of a device covered by Soviet Patent No 602935 [see "Otkrytiya, izobreteniya, promyshlennyye obraztsy, tovarnyye znaki," No 14, 1978, p 181]. The unit is designed for use in data reduction systems based on YeS EVM computers. The UPI handles automatic preparation and transcription of data on the YeS-5012 magnetic storage unit. The UPI can receive data from various sources with digital output with maximum word length of 16 bits. Interchangeable interface boards are provided. Data input rate is 64 kbytes/s with recording density of 32 lines/mm, or 16 kbytes/s with recording density of 8 lines/mm. The device controls the magnetic tape store and checks the recording quality. The device also interacts with a videoton-340 terminal that has access to the buffer storage, consisting of two modules with capacity of 8K bytes each. The UPI is made with series 133 ICs. Supply voltage is 220 V, power consumption is no more than 100 W. Measurements 640 x 720 x 220 mm, weight 35 kg. Figures 1.
[136-6610]

USSR

UDC 681.327.11(088.8)

A CODER FOR PROPORTIONAL CHAMBERS

Moscow PRIBORY I TEKHNICA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 64-66 manuscript received 12 Jul 78

RADZHABOV, R. S., Joint Institute of Nuclear Research, Dubna

[Abstract] A coder for a proportional chamber is described that meets the following requirements: 1) High speed; 2) Simplicity and small volume of equipment; 3) Compatibility with standard electronic modules

for multiwire proportional chambers; 4) Reception of correct data from one of the activated wires when two adjacent wires are activated by one particle; 5) Differentiation of a situation where a cluster has activated two adjacent wires; and 6) Monitoring of proper transfer of information from the chamber to the accumulator. The unit encodes information from 63 wires in binary code for single-track events. When two adjacent wires are activated by one particle, the odd-numbered wire is recorded, and a pulse is generated that shows the occurrence of a cluster. Data transmission is checked by generation of a control bit that complements the number of ones at the output to an even number. Input and output levels -- TTL, number of inputs -- 2×63 , number of outputs -- 2×8 , conversion delay 30 ± 5 ns, power supply +6 V, 0.3 A. The coder is made with 33 series 155 ICs. Two independent coders with 63 inputs each are accommodated in a double-width CAMAC crate. The author thanks G. V. Plotitsyn for technical assistance, T. F. Sapozhnikova and A. D. Rogal' for assistance with the tests, and also M. D. Shafranov, A. D. Kirillov and N. M. Nikityuk for support in the work and constructive criticism. Figures 3; references 10: 8 Russian; 2 Western. [136-6610]

USSR

UDC 681.518.3

A MULTICHANNEL SYSTEM FOR STUDYING VOLTAGE PULSE SHAPE

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 177
manuscript received 5 Jun 78

BONDAROVICH, G. G., SOKOLOVA, N. A., TSYVINSKIY, V. G. and OLESHCHUK, V. A.

[Abstract] This system is designed for automatic data gathering in physical optics research with subsequent computer processing. There are 128 multipoint analog memories for preliminary storage of instantaneous values of analog signals, 8 analog-digital converters, commutators for 16 inputs, a control unit, a 4-kbyte buffer store, oscilloscope and LED displays, peripherals and an F5033K printer. A calibrating system is included for ensuring required precision. A program package has been developed for calibration and for data processing on the YeS-1020 computer. The system is accommodated in two standard ASVT-M bays measuring $170 \times 60 \times 70$ cm. Input pulse duration range is from 10 μ s to 9 ms. Parallel 8-place output code on TTL level. Power consumption is 1.25 kW on 220 V. Figures 1. [136-6610]

WIDTH CODING OF COMPUTER-GENERATED FOURIER HOLOGRAMS

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 7, Jul 79
pp 56-60 manuscript received 20 Dec 78

BAN'KOVSKAYA, YE. N., MAYOROV, S. A., OCHIN, YE. F., ROMANOV, YU. F.
and TROPCHENKO, A. YU., Leningrad Institute of Precision Mechanics and
Optics

[Abstract] Methods of digital holography are employed in computer technology in generating matrices of Fourier holograms for page-oriented holographic permanent memory units. A Fourier hologram is generated by calculation of a digitized Fourier transform of the original image and then coding the distribution of the complex amplitudes obtained. The result is the distribution of the transmission coefficient in the plane of the hologram generated. The amount of transmission at an arbitrary point on the hologram can be set equal to either zero or one for convenience in photographic recording of the hologram, i. e., binary coding can be employed. A theoretical discussion is presented of the coding of computer-generated Fourier holograms by three different methods. One of the most widespread methods of coding is that of Lohman (1967) whereby the plane of a Fourier image is divided into cells and a reading in each cell is coded in the form of an aperture with transmission equal to one. The width of the aperture is constant, its height is proportional to the amplitude of the reading, and the shift in relation to the cell's center is proportional to the reading's phase. The coding of a Fourier image is discussed in the case when the original image is a function of a single coordinate and an equation is presented for the reading of the Fourier image in a cell. This reading is coded by a structure depending on a single coordinate by employing the width modification of the Lohman method, whereby the parameters of the aperture are selected so that its height equals $H = \Delta\eta$, the shift is a function of the reading's phase, and the width of the aperture is a function of the reading's amplitude. According to the Lohman method, the plane of the Fourier image is divided into cells of dimension $\Delta x_0, \Delta y_0$, whereby the steps for digitization of Δx_0 and Δy_0 are selected on the basis of the referencing theorem: $\Delta x_0/\lambda f = \Delta\xi = 1/2X$, $\Delta y_0/\lambda f = \Delta\zeta = 1/2Y$, where f is the focal length of the lens used in reconstructing the image, λ is the wavelength of the light, ξ and η are spatial densities, and X and Y are the maximum dimensions of the original image for coordinates x and y . A sketch is shown of the position of the aperture in the cell, where it is shown that in this case the apertures form a system of transparent slits parallel to axis η . A theoretical analysis is made of the process of reconstructing the image from a hologram constructed by this method. Width coding is illustrated for the case of a Fourier transform of two infinite slits of a specific width which are a specific distance apart. The result of coding the Fourier transform is illustrated

graphically. The image was reconstructed from the hologram by means of an LG helium-neon laser. The width method of coding is convenient to use in coding Fourier transforms in a polar system of coordinates, where the amplitude is coded by the width of a section of a ring placed in the cell, and the phase by the radial displacement of this part of the ring. In the case of circular symmetry, the Fourier image is coded by a system of concentric rings of different width. Also discussed is the method of binary width coding in which each reading is coded in the form of two circular or rectangular apertures with variable amplitude transmission, whereby the position of the apertures in a cell is strictly fixed. A modification of this method is the binary coding method in which to the coded reading are compared two transparent rectangular apertures with equal widths and variable heights. Another variation is discussed in which the complex amplitude of the coded wave front is expanded in terms of three basis vectors rather than four. Combined coding, in which is employed a combination of binary coding by height and width, makes possible a greater number of possible readings and therefore greater coding accuracy. The paper was recommended by the Department (Kafedra) of Computing Techniques. Figures 2; references 5: 2 Russian, 3 Western. [33-8831]

USSR

UDC 621.372.542

EVALUATION OF THE FEASIBILITY OF USING A SYSTEM OF RESIDUAL CLASSES IN
SIGNAL PROCESSING EQUIPMENT

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 1, 1980 pp 75-76
manuscript received 22 Dec 78; after revision, 3 May 79

SHUBS, YU. V.

[Abstract] It has been shown that arithmetic based on systems of residual classes accelerates operations of multiplication in signal processing based on discrete filtration and discrete Fourier transformation. But considerable time and equipment is needed for the final nonmodular procedures, which may cancel out the advantages of using a system of residual classes. In this paper, the author evaluates the advisability of using such a system in signal processing equipment. For purposes of the analysis, the hardware for signal processing is divided into noniterative, in which the intermediate results are incorporated into the final product of processing in additive combinations, and iterative, in which the intermediate data are incorporated into the result in additive and multiplicative combinations, increasing with respect to the modulus from iteration to iteration. The analysis shows that a system of residual classes can be recommended for use in noniterative devices when the number of readings N in realization of the processed signal is greater than 128, i.e. in cases where the volume of nonmodular operations is no more than about 25 percent of the total number of modular operations. The relative volume of nonmodular operations in iterative devices is practically independent of N , and therefore a system of residual classes can be of benefit here only for N much greater than 128, where the speed of noniterative devices is not sufficient for real-time processing. When N is less than 128, the system of residual classes can be used in either type for signal processing by a tabular method. Figures 1; references 3: 2 Russian; 1 Western.
[159-6610]

USSR

UDC 621.391.8

FREQUENCY SELECTION IN THE CONTROLLING CIRCUIT OF A NOISE DISTURBANCE
COMPENSATOR

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 1, 1980 pp 32-37 manuscript
received 14 Feb 78; after revision, 24 Apr 79

KRASIL'NIKOV, V. D. and RODIONOV, YA. G.

[Abstract] The compensation method is widely used for suppression of radio interference. If spatial selection of the interference and signal

waveforms is used to set up an additional difference between them, the signal can be isolated against a background of intense interference. The interference usually enters the signal channel of the compensation device through the side lobes of a directional signal antenna. The antenna of the compensation channel is usually weakly directional, so that the signal level in this channel is considerably lower than in the signal channel. Thus the subtraction of nearly identical interference waves has almost no effect on the intensity of the useful signal. However, the degree of compensation is adversely affected if even a part of the useful signal enters the compensation channel. This is because of the undesirable signal control of quadrature components. The requirements of the controlling circuit of a compensation type interference suppression device are analyzed when the received radio signal has a spectrum concentrated close to certain main segments, e. g. a telemetric signal, and it is shown that signal control of quadrature components in such a case increases the degree of compensation of noise disturbances even when the amplitude-phase responses of the channels are appreciably different. Expressions are given for the weighting factors of the quadrature channels of the compensation device. Figures 3; references, 4 Russian.
[159-6610]

USSR

UDC 621.391.81

ANALYSIS OF INTERFERENCE IMMUNITY OF DATA PROCESSING SYSTEMS UNDER CONDITIONS OF THE INTERFERING ACTION OF SEVERAL PULSE DISTURBANCES

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 1, 1980 pp 11-19
manuscript received 2 Oct 78

KONTOROVICH, V. YA. and POLOZOK, YU. V.

[Abstract] An approach is proposed to an analytical investigation of the interference immunity of data processing systems in the case of additive action of pulse interference, such as industrial interference, on the inputs of various components of the processing equipment. Systems are considered with time separation of channels, and also with frequency separation of channels in three variations: 1) With a completely linear channel; 2) With a nonlinear group channel, but with linear partial processing channel; and 3) With a nonlinear partial processing channel. It is shown that the interference immunity of all data processing systems is determined by the intensity of the interference, the distribution parameters and the spectral density of the pulse signals. Systems with time separation of channels are more resistant to interference. Systems with time separation of channels are more resistant to interference. Systems with time separation of channels show appreciable nonuniformity of points of penetration of interference into the different channels

of the equipment. Different systems with frequency separation of channels and nonlinear processing channels are equivalent, and superior to systems with linear processing channels. Figures 2; references 7: 5 Russian; 2 Western.
[159-6610]

USSR

UDC 621.391.193

ACCURACY OF MEASUREMENT OF THE FREQUENCY AND ANGLE OF ARRIVAL OF SIGNALS RECEIVED BY AN ANTENNA ARRAY AGAINST A BACKGROUND OF INTERFERENCE WITH ACOUSTIC-OPTOELECTRONIC PROCESSING

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 1, 1980 pp 3-10 manuscript received 19 Oct 78; after revision, 5 Apr 79

NAKHMANSO, G. S.

[Abstract] An examination is made of the influence that external additive jitter and set noises of optoelectronic systems in an acoustic-optoelectronic processor have on the accuracy of measurement of the frequency and angle of arrival of a narrow-band radio signal and a normal random process received by a linear antenna array. The lag time of the optoelectric system is taken into consideration in the accuracy evaluation. An analysis is made of the statistical characteristics of the estimates of frequencies and angles of arrival at the output of the optoelectronic system of the acoustic-optoelectronic processor. A linear equidistant antenna array is considered with an odd number of elements spaced by a given distance. An example is given of measurement of the frequencies and angles of arrival of a square-pulse signal and a normal narrow-band process against a background of white noise. Figures 3; references: 5 Russian.
[159-6610]

USSR

UDC 621.396:967

DIVERSITY RECEPTION WITH ADAPTIVE SIGNAL RELAY IN MOBILE RADIO SYSTEMS

Kiev IZV.VUZ: RADIOELEKTRONIKA in Russian No 1, 1980 pp 87-89 manuscript received 17 Oct 78; after revision, 18 Jun 79

GOLOVIN, E. S.

[Abstract] One of the causes of reduced reliability of data transmission in mobile radio systems in the UHF band is rapid signal fading caused by multibeam radio wave propagation. So far, space diversity reception

has not been considered applicable to control of fading in mobile systems. The author proposes systems in which two copies of the signal adaptively processed at the base station are transmitted with space diversity, combined, and received by a single antenna on the mobile station. Versions with spatial autoselection and with spatial linear adding are considered. The proposed designs require only minimum modification of the mobile equipment, and at the same time, with proper choice of parameters, realize all the advantages of diversity reception from the standpoint of improved reliability of communications in channels with fading. Figures 2; references 6: 4 Russian; 2 Western.
[159-6610]

USSR

UDC 621.317.757:534.29:535.21(088.8)

A QUARTZ ACOUSTICO-OPTICAL FILTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 170
manuscript received 2 Feb 78, after revision 12 Jul 78

VIZEN, F. L., ZAKHAROV, V. M., KALINNIKOV, YU. K., MAGOMEDOV, Z. A.,
MASLENNIKOV, V. N. and PUSTOVOYT, V. I.

[Abstract] This filter isolates a narrow spectral region of optical emission with rapid electronic tuning over the entire wave band. The device includes an acoustico-optical cell, a system for input of the controlling electric signal, input and output polarizers. Optical radiation is filtered by utilizing the interaction between light and ultrasound propagating collinearly in the acoustico-optical cell on an X-cut quartz crystal. The polarization of the optical output wave in the filtration band is orthogonal to the polarization of the input optical wave, so that the useful signal can be isolated by orthogonal placement of the input and output polarizers. Working wavelength band 400-700 nm, passband width 0.15-0.22, transmission factor 76 percent, tuning time 30 μ s, controlling acoustic power density 100 mW/mm², dimensions 60 x 60 x 300 mm, weight 0.7 kg. Figures 1.
[136-6610]

USSR

UDC 621.391.266

DIGITAL NONSTATIONARY SMOOTHING FILTERS

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 7, Jul 79
pp 7-11 manuscript received 12 Dec 78

BOBIKOV, A.I. and GAVRILOV, A. N., Ryazan' Radio Engineering Institute

[Abstract] Nonstationary digital filters with a growing memory (TsFR's) exist which are optimal in terms of a minimum root-mean-square error. The algorithms for the operation of these filters are constructed on the assumption of invariability along the entire time axis of the order of the polynomial used for the purpose of approximating the useful signal. A dynamic error which increases with time is caused by derivatives of the useful signal which are not taken into account in the case when a description of the useful signal by a polynomial of a specific degree is possible only in an instantaneous interval with a duration of N quantization periods. Digital smoothing filters are possible which make it possible to eliminate this disadvantage of TsFR's. These are nonstationary digital smoothing filters with a growing memory which have

a practically finite duration of the transient process, TsFRB's. TsFRB's, however, involve additional equipment costs, since they utilize more complicated expressions for the factors included in the filtering algorithm, and also greater expenditures of time are required for computing these factors, thus making it impossible to process information in real time in a number of applications. Discussed here are nonstationary digital smoothing filters which process a signal at the first stage of $0 < n < n_0$ according to the algorithm for the operation of a TsFR filter, and then at moment n_0 switch to the algorithm for the operation of quasi-optimal digital filters, KTsf's. The smoothing algorithms for TsFR and KTsf filters are identical in form, making it easy to switch from the operating algorithm of a TsFR filter to that of a KTsf filter while preserving the recurrent nature of the smoothing procedure. Equations are presented for both TsFR and KTsf filters, and it is shown that it is possible to produce filters which before moment of time n_0 behave as TsFR filters, and beginning with moment n_0 as KTsf filters. These nonstationary filters are called switching filters, TsFRP's. The instant of switching, n_0 , is selected on the basis of the condition of approximate equality of the lengths of the transient processes of TsFRP and KTsf fillers occasioned by a specific unaccounted-for derivative of the useful signal. The instant of switching is found for filters having astatism of the first order and of the second order, TsFRP₁ and TsFRP₂, respectively. An evaluation is made of the quality of processing, distorted by noise in the form of discrete white noise of the useful signal, by means of TsFRP filters. It is demonstrated that the use of TsFRP₂ filters results in a gain in filtering accuracy under transient conditions, as compared with KTsf filters, and that this gain is greater, the greater the ratio of the square of the rate of change in the useful signal to the dispersion of the noise. It is also demonstrated that a TsFRP₂ filter is more economical in terms of equipment costs and faster acting than a TsFRB₂ filter, although both are equal in smoothing quality. The paper was recommended by the Department (Kafedra) of Automatics and Telemechanics. Figures 2; references: 3 Russian.

[33-8831]

USSR

UDC 681.325.3

A TWO-CHANNEL ANGLE-TO-CODE CONVERTER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
p 168 manuscript received 3 May 78

BUCHINSKIY, YA. V., MARCHENKO, P.M., PISKUN, S. A., STOLYAROV, A. A.,
UZLOVA, L. A. and SHATSKIKH, YU. V.

[Abstract] This converter can be used as a connecting link between object and computer in measurement systems and in systems for automatically monitoring and controlling technological processes. The angle-data transmitters are non-contact selsyns that can be located 200 m away from the instrument, which contains two identical angle-to-code converters. Each converter changes the angle of shaft rotation of the selsyn to 16-place binary code and the corresponding binary-decimal code, determines the direction of rotation and resets to zero for any shaft position. Information on shaft position and initial conditions is retained for up to 2 hours when the power is disconnected. The measurement results or code of initial conditions are digitally displayed on the front of the instrument and on two remote displays. Maximum resolution within one revolution is 7 binary digits, and time of measurement is 5 ms or less. Principal error is ± 1 in the least significant place. Power consumption is 35 VA or less on a 220 volt supply. Measurements -- 495 x 200 x 480 mm, weight 20 kg or less. Operating conditions conform to group II of State Standards GOST 9763-67. Figures 1.
[136-6610]

USSR

UDC 681.327.11

CONCERNING THE POSSIBILITIES FOR STANDARDIZING ANALOG-DIGITAL CONVERTERS
OF HODOSCOPIC REGISTRATION SYSTEMS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 72-78 manuscript received 29 Jun 78

BASILADZE, S. G. and LOKHONYAN, L., Joint Institute of Nuclear Research,
Dubna

[Abstract] Currently used hodoscopic systems for registration of nuclear particles consist of a comparatively large number of detectors. In type I systems each detector, with specified geometric dimensions along one coordinate or in the plane, is a direct sensor of information (in the amount of one bit) on the coordinate of particle passage through the surface formed by the hodoscope detectors. In this paper, the authors consider electronic modules for type II hodoscopic systems in which the

detectors are sensors of analog information (in the amount of 8-10 bits each) on some parameter of the registered particle, such as time of a arrival, pulse charge or pulse amplitude. An examination is made of the feasibility of standardizing converters for changing charge, amplitude and time intervals to digital code, based on an intermediate converter of analog signal to time interval. A theoretical analysis is made of the amount of distortion of information in structures where a small number of coders serve a large number of signal sensors. The most effective converters are selected for different loads on the hodoscopic system. It is shown that the proposed structures register only significant information, which considerably reduces the time of data accumulation. Figures 8; references 10: 6 Russian; 4 Western.
[136-6610]

USSR

UDC 621.396.662:621.385.6

A CRYOGENIC STABLE-FREQUENCY MICROWAVE OSCILLATOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
p 184 manuscript received 3 May 78

BOBRYSEV, V. D., DMITRIYEV, V. M., KIZILOV, V. I., PRENTSLAU, N. N.
and YATSENKO, V. A.

[Abstract] The oscillator is a reflex klystron with automatic frequency control by a passive standard -- a cutoff resonator with H_{011} mode, thermally stabilized in liquid nitrogen. This resonator is an evacuated quartz biconical cavity with base diameter of 50 mm and vertex angle of 60° . The inside of the cavity is metallized with sputtered copper. The loaded Q of the cavity is $5 \cdot 10^4$ at 77 K. The resonator is enclosed in a cryostat with the microwave circuits on the cryostat cover. The power supply and AFC system are accommodated in a separate module. Frequency 9 GHz, output power 50 mW, relative instability of frequency 10^{-8} per day and $7 \cdot 10^{-9}$ per hour. The cryostat has a capacity of 10 liters and operating time of 5 days. If an external tunable oscillator or frequency synthesizer is used in place of the reference quartz-crystal oscillator supplied with the unit, the frequency of the microwave oscillator can be tuned over a range of 10 MHz. Figures 1.
[136-6610]

USSR

UDC 537.521.7

SURFACE CHARGE DISTRIBUTION FOR DISCHARGE IN A GAS GAP WITH A DIELECTRIC ON THE ELECTRODE

Moscow ELEKTRICHESTVO in Russian No 2, Feb 80 pp 61-63 manuscript received 16 Feb 79

SERGEYEV, YU. G. and SOKOLOVA, M. V., Moscow Power Engineering Institute

[Abstract] An investigation is made of the nature of the distribution of the charge that settles on the surface of a dielectric where there is an electric discharge in an air gap with a dielectric on one electrode. The studies were done by an electrographic method in weakly inhomogeneous and homogeneous electric fields with constant, 50-Hz alternating and pulsed voltages. The electrograms of the surface discharge that develops with streamer sparking have the same appearance as in the case of normal surface discharge. It is concluded that the surface discharge develops nearly simultaneously with the discharge in the gap. In the case of alternating voltage, the discharges in air in any given half-period develop in regions where the field is intensified by charges that have settled on the dielectric during the preceding half-period. Thus the discharges that occur during the first half-period after voltage application determine the location of discharge development in subsequent half-periods, which must be taken into account in the operation of ozonizers since successive discharges in certain sections of the dielectric may break down the electric strength of the glass barrier. Figures 3; references: 4 Russian.
[160-6610]

USSR

UDC 621.311.4

ON CALCULATING THE ELECTRIC FIELD OF SPHERICAL AND TOROIDAL SHIELDS OF GAS-INSULATED HIGH-VOLTAGE EQUIPMENT

Minsk IZV.VUZ: ENERGETIKA in Russian No 11, Nov 79 pp 23-29 manuscript received 2 Mar 79

YARMARKIN, M. K., engineer, Leningrad Polytechnical Institute imeni M.I. Kalinin

[Abstract] High-voltage equipment with compressed gas insulation is widely used in research, industry and other fields. This equipment is frequently housed in hermetically sealed cylindrical shells. The author considers electric fields of spherical and toroidal shields in a grounded coaxial cylindrical shell. The field set up by the sphere

is approximated by the field produced by a point charge on the axis of a grounded cylindrical cavity, and the torus is approximated by an infinitely thin filamentary ring. The errors introduced by this idealization are estimated, and the limits of applicability of the model are determined. Expressions are derived for calculating the capacitance and intensity of the electric fields. On the basis of computer analysis, simple empirical expressions are given that approximate the necessary improper integrals of complex functions. A simple empirical formula is given that approximates the field strength on toroidal and spherical shields as a function of their geometry. The paper was presented by the Department (Kafedra) of Electrical Apparatus. Figures 3; references: 7 Russian. [162-6610]

USSR

UDC 621.316.98:621.375.8

ON THE FEASIBILITY OF IMPROVING THE PROTECTIVE EFFECT OF LIGHTNING ARRESTERS BY USING A LASER SPARK

Moscow ELEKTRICHESTVO in Russian No 2, Feb 80 pp 47-48 manuscript received 14 Jun 78

ALEKSANDROV, G. N., IVANOV, V. L., KADZOV, G. D., PARFENOV, V. A., PAKHOMOV, L. N., PETRUN'KIN, V. YU., PODLEVSKIY, V. A. and SELEZNEV, YU. G., Leningrad Polytechnical Institute imeni M. I. Kalinin

[Abstract] An analysis is made of a technique for increasing the effective height of a lightning arrester by producing a highly ionized channel (laser spark) above it. Experiments were done on scale models. Two methods are proposed for synchronizing the laser spark with the lightning flash: by using a photomultiplier, and by using a capacitor. Statistical processing of the results of experiments shows that the proposed laser spark technique reduces the probability of lightning damage from 0.26 to 0.08. Figures 4; tables 2; references 4: 3 Russian; 1 Western. [160-6610]

USSR

UDC 621.319.7:001.24

ON CALCULATION OF ELECTROSTATIC FIELDS BY THE METHOD OF EQUIVALENT CHARGES

Moscow ELEKTRICHESTVO in Russian No 2, Feb 80 pp 26-31 manuscript received 29 Aug 79

BLOKHIN, YU. V., ZHURAVLEV, E. N. and YAROSLAVSKIY, V. N., Moscow

[Abstract] Many problems of electrostatics require calculation of the potential and strength of the electrostatic field under conditions where the exact analytical solutions of Laplace or Poisson equations are not known. In particular, it is frequently necessary to study the field distribution in a system of electrodes including a sharp point and a flat plate. This article considers such an electrode system when there is no space charge in the gap. The purpose of the work is to improve accuracy of the resultant solutions. The analysis is based on the method of equivalent charges, which involves determining the electric field potential at any point of the interelectrode gap in the form of a linear combination of arbitrary harmonic functions. Criteria are formulated for estimating the error of electrostatic field calculations by this technique, and an algorithm is proposed for automatic selection of the coordinates of reference points and parameters of equivalent charges. It is shown that this algorithm gives the characteristics of the field in the vicinity of the axial line of the electrode system with an error of not more than 1 percent. Figures 2; tables 2; references 11: 7 Russian; 4 Western.
[160-6610]

USSR

UDC 681.327.3

DURABILITY OF VACUUM FREQUENCY COMMUTATING ELEMENTS

Moscow PRIBORY I TAKNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 pp 129-132 manuscript received 28 Jun 78

VORONEZHSKAYA, I. A., KOSMARSKIY, L. N., SINEL'NIKOVA, L. G. and EYG, L. S.

[Abstract] Vacuum commutating elements with cold cathodes can be used at working voltages from 50-100 V to several tens of kilovolts for switching pulse currents from a few amperes to tens of thousands of amperes. A disadvantage of these devices is their poor durability because of erosion. The authors report on measurement of erosion of electrodes in vacuum commutating devices operating at firing rates from 50 to 1000 Hz. It is shown that electrode erosion decreases with increasing

firing rate for switching of the same pulse energy. With operation at a firing rate of 1000 Hz, almost no cathode destruction is observed, and there is practically no metal deposition on the anode or igniter system even when magnesium is used as the cathode material. Dischargers used at this firing rate remain operable for more than $5 \cdot 10^6$ operations. Figures 3; references: 4 Russian.
[136-6610]

USSR

ALL-UNION UNIFIED SERIES OF INDUCTION MOTORS 4A

Moscow ELEKTRICHESTVO in Russian No 2, Feb 80 pp 1-2

BAKUMOV, YU. V., VORONOVSKIY, G. P., GAZAROV, L. A., ZINCHENKO, O. L., IOSIF'YAN, A. G., SOROKER, T. G., KESTLER, C. (East Germany), NICHOFF, G. (East Germany), KLIMOVICH, G. M., KOSTROMIN, V. G., PETROV, V. M. and RADIN, V. I.

[Abstract] The authors have been awarded a State Prize of the USSR for 1979 for their development and introduction of the unified series of 4A induction motors. This series covers the motor power range from 0.12 to 400 kW. In addition to the basic model, the series provides for electrical, mechanical, climatic, specialized and narrowly specialized modifications (for agriculture, the sewing industry, the printing industry and so forth). The motors use specially developed insulating materials, the latest cold-rolled transformer steel developed by the Central Scientific Research Institute of Ferrous Metallurgy, and newly designed sealed-lubricant ball bearings developed by the All-Union Scientific Research Institute of the Bearing Industry. The motors of the series meet all requirements of international standards, with power one or two steps higher than that of non-Soviet motors of the same size. Retooling of the machine plants that make the series 4A motors has increased labor productivity by a factor of 2.5. More than 15 million motors of this series have been produced during the Tenth Five-Year Plan. Use of these motors is saving about 4 billion kWh of electric energy yearly.
[160-6610]

USSR

UDC 621.039.637:621.315.5

SELECTING THE PARAMETERS OF A CAPACITIVE ENERGY ACCUMULATOR FOR PULSE
HEATING OF CONDUCTORS

Moscow ELEKTRICHESTVO in Russian No 2, Feb 80 pp 58-60 manuscript received
11 Jun 79

GRIGOR'YEV, I. N. and LAPSHIN, YE. I., Moscow

[Abstract] The transient process is analyzed in a nonlinear RLC circuit, and it is demonstrated that conductors may be heated under pulse conditions with minimum current amplitude. A technique is developed for selecting the parameters of a capacitive energy accumulator. The results of numerical calculations are analyzed to find the parameters of the discharge circuit that minimizes the current amplitude. Under certain conditions of cooling of a heated element, the results of the calculations can be used to select the parameters of a capacitive energy accumulator that operates in a steady frequency cycle. Figures 4, references:

6 Russian.

[160-6610]

USSR

UDC 006.354.065:621.317.784.029

STANDARDIZATION OF MICROWAVE-POWER WATTMETERS AND OF METHODS OF THEIR
INSPECTION

Moscow IZMERITEL'NAYA TEKHNKA in Russian, No 2, Feb 80 pp 63-66

CHUYKO, V. G.

[Abstract] Microwave-power wattmeters have been standardized in GOST 13605-75 ("Microwave-power wattmeters: technical requirements and methods of testing"), GOST 13606-68 ("Receiver-transducers of bolometric and thermistor wattmeters: types, basic parameters and technical requirements"), GOST 15129-69 ("Bolometric and thermistor types of microwave low-power wattmeters and their receiver-transducers: methods of inspection and certification in the 20-37,500 MHz frequency range"), and MI80-76. There are also four standards for government etalons and All-Union inspection procedures for microwave-power wattmeters with waveguide and coaxial inputs in the 30-78,330 MHz frequency range. These standards are being revised and updated, to cover all wattmeters and primary instrument power transducers, to establish a maximum correlation between them and to eliminate any contradictions in them. Certain concepts and terms are also more precisely defined in the process, especially those pertaining to scale calibration whether in units of incident or absorbed power, its frequency factor and error. Improvements, expansions and innovations which occur continuously and require some degree of flexibility are also taken into account.
[161-2415]

USSR

UDC 389.14:53.089.68:529.781

IMPROVEMENT OF TIME AND FREQUENCY SYNCHRONIZATION

Moscow IZMERITEL'NAYA TAKHNIKA in Russian, No 2, Feb 80 pp 19-21

PALIY, G. N. and PUSHKIN, S. B.

[Abstract] Precise time and frequency synchronization with the USSR State Time and Frequency service is very important in aero-space navigation, radio astronomy, communication and various scientific activities. The method first used in the Soviet Union was simultaneous transmission and reception during special testing periods, with a time error not exceeding 0.0001 s (0.00003 s in the major Moscow radio stations RYeS, RVM, RAT) and the relative frequency error not exceeding $5 \cdot 10^{-11}$. After the international astronomical second and a nonuniform scale has been replaced with the national atomic second and a stepwise uniform

scale, the first practical state standard of time and frequency with a duplication error of $(5-10) \cdot 10^{-12}$ has been in use since 1967. Since 1972 this system has been adopted worldwide. Further improvements in synchronization precision have been found possible, according to results of research done in the Soviet Union, namely by communication over direct land television channels and apparatus changes which involve storage of the time scale, generation of special synchronizing pulses, and innovation of receiving-recording equipment for users. Feasibility studies have already been made along the Moscow-Gorkiy route with reflections from meteor trails. Special equipment for synchronization within 0.3-0.5 microsecond has already been installed on the Novosibirsk-Irkutsk route and the Moscow-Kharkov route. Transmission of standard time and frequency signals through radio stations has been improved by equipment modernization and partial replacement. Use of special-purpose satellites for synchronization is to be expected in the near future. Since 1977 bulletins of "standard time and frequency signals" have replaced the old schedules. A leading role in all these developments is played by the All-Union Scientific Research Institute of Physico-technical and Radiotechnical Measurements, its Siberian and Khabarovsk branches, the USSR Academy of Sciences and the USSR Ministry of Communications. References: 9 Russian.

USSR

UDC 389.14:61

ACHIEVEMENTS IN MEDICAL METROLOGY

Moscow IZMERITEL'NAYA TAKHNIKA in Russian No 2, Feb 80 pp 61-63

DADASHEV, R. S.

[Abstract] Medical metrology is concerned with the physical properties of biological objects on the one hand and with functions of sensory systems in a living organism on the other. Both areas of measurement require special standards and units or equivalents as well as establishment of the laws relating the quantities involved in a measuring process. Noteworthy achievements in medical metrology made during the nineteen seventies are: in electrical measurements (electric field of the heart, the brain, a muscle; impedance of the integument and of tissues), in vibroacoustic measurements (characteristics of the auditory analyzer, vibrations of the body surface due to heart beats and blood circulation, propagation and attenuation of ultrasonic waves in the body), in mechanical measurements (breathing, blood pressure), and in optical measurements (transmission and reflection of light by various parts of the body such as finger tips and ear lobes). Other achievements include a system of measures duplicating dynamic quantities, i.e., quantities which are functions of time according to the method of discrete representation and storage of instantaneous values with subsequent conversion

to analog signals by linear interpolation. They also include calibration of aggregate instrument sets and systems for combined and simultaneous measurement of several quantities, a set of special measures and international standards for calibration of medical measuring instruments used in diagnosis, prophylaxis, and checkups. All these developments are essentially based on automatic measurement of the amplitude-time characteristics of infralow-frequency signals, semiautomatic oscillography, and linear transposition of original signal spectra to the high-frequency range for processing and analysis with available apparatus. There are still being developed tissue-equivalent phantoms and international standards for measuring the power of absorbed energy doses, there are further studies made of biological fluids and their standardization for calibration of such as cytometers. Activities in medical metrology are supervised by the State Standards Metrological Service, with the participation of the Ministry of Health and the Ministry of the Medical Industry.
[161-2415]

USSR

UDC 529.781:621.397.089.6

ANALYSIS OF ERRORS IN SYNCHRONIZATION OF TIME SCALES ALONG WIDEBAND COMMUNICATION CHANNELS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 80 pp 21-22

SOPEL'NIKOV, M. D. and FEDOROV, YU. A.

[Abstract] Secondary standards in the USSR State Time and Frequency Service, with a duplication error of $(3-10) \cdot 10^{-13}$ over a monthly period, are usually verified by checking against quantum clocks. This procedure is unwieldy, owing to the difficulty of transporting such clocks over long distances. Regular verification over meteor trails or direct land television channels is much simpler but also so much less accurate as to require an error analysis. Such an analysis was made on the Moscow-Kharkov route, with equipment built for this purpose at the Kharkov Institute of Radio Engineering. Verification by the counterflow method is more accurate without than with subsequent signal relaying, as indicated by the smaller rms error and the much higher correlation factor. A statistical evaluation of the results of 19 tests during 80 days from 1 Dec 76 to 15 Feb 77 with a secondary cesium standard indicates that verification over meteor trails is somewhat more accurate than verification over television channels, although both methods are fairly consistent. The difference of 0.68 microsecond between them at midpoint of the testing period and the rms error of 0.1 microsecond over the entire testing period indicate an improvement of the verification technique with time. Moreover, television channels are subject to seasonal fluctuations. Figures 4; tables 2; references: 4 Russian.
[161-2415]

A SPECTROMETER FOR HIGH-CURRENT TUBULAR ELECTRON BEAMS

Moscow PRIBORY I TAKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 44-46 manuscript received 10 Jul 78

BUGAYEV, S. P., DERGOBUZOV, K. A., KARMADONOV, A. N., KONONOV, B. A.,
KOSHELEV, V. I. and AYGUSHKIN, N. I., Institute of High-Current Elec-
tronics, Siberian Department, Academy of Sciences USSR, Tomsk

[Abstract] A spectrometer is described for tubular electron beams produced in diodes with magnetic isolation where there is a transverse component of electron velocity. The installation for which this spectrometer was developed could not utilize a magnetic spectrometer with semicircular focusing because of the complexity of the shielding on the electron transport channel between the accelerator and spectrometer. The spectrometer is made up of a measuring module and a recording module. The measuring module is a cylinder accommodating a matrix with radiation absorber, cumulative capacitors and commutating devices. The radiation absorbers are made up of aluminum foil with polyethylene film insulation between layers. The spectrum is reconstructed on a computer from the measured distribution of particles absorbed in the sectionalized absorber. The authors thank A. P. Yalovets for assisting with the calculations, and A. P. Ten for helping with adjustment of the facility. Figures 3; references 11: 8 Russian; 3 Western.
[136-6610]

A SPECIAL STATE STANDARD OF A UNIT OF SPECTRAL POWER DENSITY OF NOISY RADIO EMISSION IN THE 2-125 MHz FREQUENCY RANGE

Moscow IZMERITEL'NAYA TAKHNIKA in Russian No 2, Feb 80 pp 11-12

PRUGLO, VITALIY IVANOVICH, chief engineer, All-Union Scientific Research Institute of Physicotechnical and Radiotechnical Measurements (VNIIFTPI)

[Abstract] A special state standard of a unit of spectral power density of noisy radio emission in the 2-125 MHz frequency range has been developed, an extension of already existing two such standards for the 125-1000 MHz and the 1.0-37.5 GHz ranges respectively. It includes a thermal noise generator in the form of a matched load at 690-760 K inside an insulated thermostat and a comparator which consists of an input switch, a matching transformer, a high-frequency modulator, a solid-state reference noise generator, a super-heterodyne receiver, a comparing circuit and an indicating device. The relative duplication error does not exceed

$\pm 1 \cdot 10^{-2}$, this error mainly being due to inaccurate measurement of the radiator temperature and determination of the temperature distribution along the connecting coaxial line. The relative random error of the comparator is within $\pm 1 \cdot 10^{-2}$ and its nonremovable relative systematic error is within $\pm 2 \cdot 10^{-2}$, the main source of error being variation of losses in the matching transformer. An adjustable impedance instead of the matching transformer, digital instead of analog data processing, and the use of a high-stability vacuum noise diode instead of the conventional 2D2S diode in the reference generator will further reduce both random and systematic errors. Figures 2; references 5: 4 Russian; 1 Western.
[161-2415]

USSR

UDC 534.41:621.317.737:519.2

PRECISION WAVEGUIDE TYPE RESONATORS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 2, Feb 80 pp 43-44

GONCHAROV, A. K.

[Abstract] Q-meters for measuring the characteristics of resonators in various microwave devices are checked and calibrated against precision waveguide resonators. The error of such a resonator must be one third of the Q-meter error. Here calculations leading to the design of a precision waveguide resonator are shown. Given are the required Q-factor under load ($Q_L = 20-30,000$), standing-wave ratio on the input side ($K_{01} = 1-20$), resonance frequency ($f_0 = 2.6-37$ GHz), coefficient of coupling to the transmission line ($\Gamma_{1,2} \gg 1$), and modulus of the transmission coefficient at resonance ($T_0 = 0-40$ dB) or standing-wave ratio on the output side ($K_{02} = 1-20$). Determined must be the type of waveguide (intrinsic Q_0 -factor), the length of its resonator segment, the losses in the resonator, and the transmittances of the coupling diaphragms or the moduli of their reflection coefficients. The equations that relate given and sought quantities are solved analytically, numerically and graphically. Actual tests and measurements indicate that this method of design is accurate within 1-3 percent for Q_L , K_0 and T_0 . Figures 4; references: 3 Russian.
[161-2415]

STATE OF THE ART AND OUTLOOK WITH REGARD TO MEASUREMENT OF FREQUENCIES
IN THE OPTICAL RANGE

Moscow IZMERITEL'NAYA TEKHNIKA in Russian, No 2, Feb 80 pp 15-19

TATARENKOV, V. M., IL'IN, V. G., KIPARENKO, V. I., KOROBOV, V. K. and
PUSHKIN, S. B.

[Abstract] The frequency of electromagnetic waves within $1 \cdot 10^{11}$ Hz is the most accurately measured physical quantity, modern corresponding time and frequency standards having an error not larger than $1 \cdot 10^{-13}$. Higher frequencies, of submillimeter and infrared waves have only been recently measured. In absolute measurements the unknown frequency is compared with harmonics of already measured lower frequencies. This is done in the case of lasers and microwave oscillators, such harmonics being generated with the aid of fast nonlinear active elements. The system developed at the All-Union Scientific Research Institute of Physicotechnical and Radiotechnical Measurements (VNIIFTRI) is a radio-optical frequency bridge consisting of a cesium radio-frequency standard, a $337 \mu\text{m}$ HCN laser, an $84 \mu\text{m}$ D₂O laser, a $10.5 \mu\text{m}$ CO₂ laser, a $10.2 \mu\text{m}$ CO₂ laser and a $3.39 \mu\text{m}$ He-Ne laser. Frequency conversion is effected by means of tungsten-silicon and tungsten-nickel point-junction diodes. The accuracy of this system has been recently improved by better stabilization of the sources in the frequency multiplication chain, the first CO₂ laser and the He-Ne laser being autonomously stabilizable (CO₂/OsO₄ and He-Ne/CH₄ respectively, the former being the least accurate link in the chain and, therefore, requiring special attention). Further spinoff derived by the use of stable lasers are the possibility of linear measurements on the basis of the international standard meter referred to the wave-length or orange Kr⁸⁶ radiation or of the latest international standard meter referred to the distance which plane electromagnetic waves travel through vacuum, time measurements on the basis of transition periods in a cesium atom, and more precise measurements of the speed of light. Many contributions in this field of measurements have been made by the National Bureau of Standards in the United States. Figures 2; references 26: 11 Russian, 15 Western.

[161-2415]

APPARATUS FOR CALIBRATION OF LOW-TEMPERATURE THERMOMETERS OPERATING IN STRONG MAGNETIC FIELDS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian, No 2, Feb 80 pp'28-31

ABILOV, G. S., ASTROV, D. N. and AL'SHIN, B. I.

[Abstract] Measurement of low temperatures in strong magnetic fields is important in the design, testing and operation of large electric power equipment which uses superconductors. The most accurate instruments for this application are resistance thermometers made of a carbon composite material and thermocoupled with a specific iron content in the copper electrode. A major problem in calibrating a low-temperature thermometer is determining the actual temperature and finding a thermometric parameter which does not depend on the magnetic field intensity. Properties of gases in a nearly ideal state and under a pressure close to saturation are sensitive to temperature but only very slightly to the magnetic field intensity. It is thus feasible to use a cryogenic substance such as liquid hydrogen or technically pure nitrogen as the calibration, and if necessary corrections are made for the dependence of the temperature and the pressure on the magnetic field intensity. An apparatus has been built on the basis of the differential method, with two isothermally coupled equal small volumes: one in a magnetic field and one outside it. A gas thermometer serves here as a null indicator the temperature of which is maintained constant by means of automatic pressure regulation. According to it, a thermometer or a thermocouple are calibrated first without and then in a magnetic field. This gas thermometer is surrounded by an adiabatic thermal shield and connected to a cryostat containing helium. The corrections to thermometer or thermocouple readings can be estimated according to the general expression for the error of temperature stabilization in a magnetic field, which also takes into account the error of field stabilization. The apparatus is adequate for certification of low-temperature (2.5-80 K) temperature measuring instruments in magnetic fields up to 9 T strong. Figures 1; references 14: 7 Russian, 7 Western. [161-2415]

REFERENCE NEUTRON FIELDS IN THE SYSTEM OF METROLOGICAL-QUALITY ASSURANCE
FOR NEUTRON MEASUREMENTS IN NUCLEAR-PHYSICS LABORATORIES

Moscow IZMERITAL'NAYA TAKNIKA in Russian No 2, Feb 80 pp 57-58

YARYNA, V. P. and GRIGOR'YEV, YE. I.

[Abstract] Neutron measurements in nuclear-physics laboratories have become a large-scale activity involving many different specialists, and maintenance of an adequate accuracy requires an appropriate system of metrological-quality assurance. Such a system, already operational, includes standard instruments with sets of nuclear activation and nuclear fission cells, standard detectors for probing the nuclear field, and reference neutron sources. The most important parameters for verification are the neutron flux intensity (neutrons/cm².s) and the neutron flux density (neutrons/cm²). The fundamental characteristic of a neutron field is the differential neutron flux intensity as a function of the neutron energy, all other characteristics can be determined from this one. Accordingly, here the concept of a reference neutron field is examined, which refers to the region of a neutron field subject to thorough probing and verification involving measurement of the differential spectrum of a given neutron reaction. The theory of this measurement is based on the rate of a neutron reaction being equal to the integral, with respect to neutron energy of the product of differential neutron flux intensity and true cross section to this reaction. The reliability of this measurement is based on the accuracy with which the various quantities in this relation have been determined. It is shown that such a reference neutron field can serve as a standard measure for verification of neutron fields. More precisely, a distinction is made between target or problem-oriented reference field and standard reference field. Examples of the latter are the neutron field of U²³⁵ fission due to thermal neutrons and the neutron field of a $\Sigma\Sigma$ source. References 6: 5 Russian; 1 Western.

[161-2415]

A METHOD OF SPECTROMETRIC ANALYSIS OF POWERFUL PULSED ELECTRON BEAMS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 40-43 manuscript received 28 Jun 78

FILIMONCHEVA, P. I., PLOKHOY, V. V., SAMOYLOVA, L. YU., AFANAS'YEV, V. N.,
KANDIYEV, YA. Z., LARTSEV, V. D. and KHOKHRYAKOV, V. F.

[Abstract] An instrument for measuring the spectra of intense pulsed electron beams is described. The unit is comprised of a system of aluminum plates sequentially arranged one behind the other normal to the beam in a vacuum. After irradiation, a thermocouple measures the temperature increment of each plate, and the spectrum of the electrons is then reconstructed from the measured profile of energy release. The calculation is based on a Fredholm's equation of the first kind that relates the energy release in a layer of homogeneous material to the electron spectrum in the beam. By approximating the spectrum as a number of energy groups, the integral equation is transformed to a system of algebraic equations that is solved on a Mir-1 computer by the method of minimizing directional divergence. The proposed spectrometer has 10 plates and works in a range of 0-2.5 MeV broken into 10 intervals of 0.25 MeV. Temperature measurements are by chromel-copel thermocouples with relative error of no more than 3 percent at 0-150°C. The recordings are made by sensitive potentiometric chart recorders. Spectra are plotted from the average of several measurements. Figures 3; tables 2; references 7: 6 Russian; 1 Western.
[136-6610]

ELECTRON PARAMAGNETIC RESONANCE SPECTROMETER WITH A GUNN-DIODE MICROWAVE OSCILLATOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 182
manuscript received 26 May 78

BELONOGOV, A. M., BOGACHEV, YU. V., VOLNYAGIN, D. P., DRAPKIN, V. Z.,
ZAYATS, V. V., MAKAROV, YU. A., MARON, R. S. and SERDYUK, A. S.

[Abstract] This EPR spectrometer is designed for mass measurements on liquids and solids under laboratory and field conditions, and also as an instructional aid. The unit uses a classical circuit with rf modulation of the magnetic field. The microwave oscillator is a Gunn diode, which has a number of advantages over a klystron: low-voltage supply (8-12V, 180-300 mA), long service life (10^4 hours), variations of about 5 percent

in microwave power over a range of 9200-9400 MHz, operable in the self-detecting mode. The circuitry is designed so that the stabilizing resonator can act simultaneously as the working resonator. Working frequency 10 GHz, sensitivity 10^{11} spins/Oe, resolution 60 mGs, maximum microwave power 40 mW. Power consumption 150 VA on 220 VAC. Measurements 1000 x 700 x 700 mm, weight 120 kg. Figures 1.
[136-6610]

USSR

UDC 620.179.14

IMPROVING THE ACCURACY OF MEASURING THE SPECTRAL DENSITY OF THE POWER OF MAGNETIC NOISE

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 7, Jul 79
pp 41-47 manuscript received 21 Sep 78

VASIL'YEV, V. M. and POPOV, A. V., Rostov-na-Donu Institute of Agricultural Machine Building

[Abstract] Instrument noise exerts a considerable influence on measurement accuracy in the investigation of the spectral density of the power of magnetic noise caused by fluctuations in the parameters of Barkhausen abrupt changes in the cyclic alternating magnetization of ferromagnetic materials. The signal-to-noise ratio can be improved by three orders of magnitude by utilizing the natural periodicity of "packets" of Barkhausen abrupt changes, for an additional measurement error takes place because of the dependence of the transmission coefficient of the synchronous detector on the shape and width of these "packets." An equation is given for the signal obtained in the output of the synchronous detector, where it is shown that only a component with a frequency of 2Ω can produce a constant component in the output of the synchronous detector. The signal in the output is proportional to the amplitude of a harmonic with a frequency of 2Ω . With wide spacing of the routine spectrum of $g(\omega, t)$, where $g(\omega)$ is the spectral density of the power and t is the time, synchronous detection with a frequency of 2ω is completely suitable for measuring $g(\omega)$. For the purpose of measuring $g(\omega)$ by the method of synchronous detection, it is possible to use as a reference voltage any frequency which is a multiple of 2Ω , or any combination of multiple frequencies, i.e., a nonsinusoidal reference signal. The spacing of the spectrum varies over a wide range for different ferromagnetics. An investigation is made here of the dependence of the additional error on the spacing of the spectrum and an analysis is made of which frequency used as a reference signal produces the lowest error when the width and shape of spikes in the $g(\omega, t)$ pulse spectrum vary over a wide range. Assuming that the phase shift between the signal and the reference voltage remains constant, an investigation is made of the dependence of the magnitude of the steady component in the output

of the synchronous detector arrived at with different harmonics on the length of "packets" of Barkhausen abrupt changes with not too great spacing. The envelope of the routine spectrum of magnetic noise is approximated by a train of cosinusoidal pulses. An expression is obtained for the voltage at the output of the synchronous detector. It is demonstrated that the higher the number of the harmonic at which synchronous detection is performed, the more rapidly is evidenced a deviation in the readings of a synchronous detector from the true value of the spectral density of the power of magnetic noise. An analysis is made of the dependence of measurement accuracy on the spacing of the envelope of the routine spectrum when using as a reference voltage different harmonics of the magnetic reversal field. It is demonstrated that an effective method of expanding the linear section for synchronous detection is that of selecting a combination of harmonics with a harmonic factor greater than one. The case is discussed when as the reference voltage is used a train of square pulses with a specific length and spectrum. An equation is derived for the voltage in the output of a synchronous detector when using a square commutation vector. It is demonstrated that a specific combination of harmonics makes it possible to eliminate practically completely the additional error with the width of "packets" of Barkhausen abrupt changes varying over a specific range. An additional error in synchronous detection is caused also by a change in the phase relationships between the envelope of the routine spectrum and the reference voltage. A shift in the maxima of the routine spectrum relative to the magnetic reversal current takes place with a change in the coercive force of the material being tested and in the amplitude of the magnetic reversal field. The conditions are found under which, when using a square commutation vector, the shift in the maxima of the routine spectrum of magnetic noise does not cause changes in the constant component in the output of the synchronous detector, i.e., the conditions under which synchronous detection practically does not introduce errors in measuring the spectral density of the power of magnetic noise. The paper was recommended by the Department (Kafedra) of Physics. Figures 6; references: 7 Russian. [33-8831]

USSR

UDC 621.3.087.92.089.6:621.317.4.7

CALIBRATION OF HALL PROBES IN PULSED MAGNETIC FIELDS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian, No 2, Feb 80 pp 66-67

CHEBURKOV, D. I., PROSKURYAKOVA, S. F. and YAGOLA, G. K.

[Abstract] Hall probes for measuring the parameters of strong magnetic fields, in the range up to 2 T, have nonlinear characteristics and must be calibrated over the entire range. When a cryogenic base for superconductor gauges is not available and the accuracy requirement is not

very stringent, it is then possible to calibrate a Hall probe in a pulsed magnetic field against a reference Hall probe which has been certified in a constant magnetic field of a superconductor gauge. Such a calibration of a Hall probe should be based on measurements of its sensitivity in a constant field of an electromagnet up to 2 T strong and of changes in its sensitivity relative to the sensitivity of the reference probe inside an induction coil energized by discharges from a capacitor bank. The sensitivity is determined with an instrument where signals from both Hall probes are compared, whereupon the instantaneous values of their difference as well as of the reference signal are measured. This method was tested on film probes with a nominal 20-120 mV/T sensitivity, using half-sine magnetic field pulses of ~ 20 ms duration and an amplitude adjustable over the 1-6 T range. An oscillograph was also used with a differential amplifier in its vertical deflection channel. The discrepancy between this calibration and one in a constant magnetic field of a superconductor gauge did not exceed 0.8 percent. References:

3 Russian.

[161-2415]

USSR

UDC 621.315.592:621.317.3.0.8

AN INSTRUMENT FOR EXPRESS MEASUREMENTS OF CHARGE CARRIER CONCENTRATION IN SEMICONDUCTORS

Moscow PRIBORY I TAKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
p 187 manuscript received 9 Jun 78

ZAKHAROV, A. A., YERMILOV, V. V., KAZANTSEV, V. V. and RYZHIY, M. Z.

[Abstract] This instrument (the Kontrol'-1) is designed for express determination of charge carrier concentration in n-type and p-type semiconductors under laboratory and shop conditions by the method of breakdown of a metal-semiconductor point contact. The instrument is used with an F2000-F2000/5 digital voltmeter, and can operate with a digital printer. Pulses of increasing amplitude are applied to the semiconductor specimen from a generator in the instrument. The breakdown voltage of a reverse-biased metal-semiconductor point contact that is determined by charge carrier concentration is fixed at a breakdown current pulse level of 10 mA and is measured by a peak detector. Breakdown voltage 0-200 V, concentration range 10^{21} - 10^{25} , 10^{20} - 10^{25} m⁻³. Breakdown current 10-12 mA, measurement time 2 s or less. Measurements 200 x 100 x 310 mm, weight 1.5 kg. Figures 1.

[136-6610]

A DEVICE THAT MEASURES AMPLITUDE-FREQUENCY RESPONSES IN THE MILLIMETER WAVE BAND

Moscow PRIBORY I TAKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 113-115 manuscript received 22 Jun 78

KOZYR'KOV, A. N., OLEYNIKOV, A. D. and PERSHAKOV, V. V., Central Scientific Research Institute of Communications, Moscow

[Abstract] The accuracy of determination of amplitude-frequency responses by automatic panoramic meters with wobblers depends appreciably on the inconstancy of the wobbulator power and the nonuniformity of sensitivity of the microwave detectors as frequency is tuned. With conventional methods of stabilizing the output power of the wobbulator, errors arise in measurement of the amplitude-frequency response because of the difference between the frequency responses of sensitivity of the detectors in the reference and measurement channels. To a considerable extent the meter described in this article is free of this disadvantage because of time separation in the formation of the reference and measurement signals with use of a single microwave detector. The wobbulator is a traveling-wave tube controlled by a sawtooth voltage generator. Connected to the output of the wobbulator is an electrically controlled attenuator. A directional coupler sends part of the power to the measurement channel containing the waveguide being studied, and the rest of the power goes to the reference channel. The difference between the powers of the detector and reference signals controls the attenuator in order to bring the power to the preset level. The instrument automatically measures amplitude-frequency responses in the 35-41 GHz band. The nonuniformity of the frequency response of the device is within 0.8 dB. Figures 2; references: 1 Russian.
[136-6610]

A DEVICE FOR MEASURING NONUNIFORMITY OF A MAGNETIC FIELD

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 172
manuscript received 17 Apr 78

BYSTROV, YU. A., ZAGRANICHNYY, YE. N. and RADCHENKO, YU. F.

[Abstract] This device utilizes a sensor that contains a cathode and an even number of sectionalized anodes. The anode sections are cross connected, each anode being made up of two pairs located on opposite sides of the cathode. This electrode system is placed so that its axis

coincides with the lines of force of the magnetic field. With the sensor thus located in crossed electric and magnetic fields, a deviation of electron flux redistributes the anode currents between sections. If the field is uniform, the cross connection between anode sections will compensate the flux deviation, and the output voltage will be zero. In a nonuniform field, the output reading will be proportional to the nonuniformity. The output response of the instrument is linear up to about 1 T/m. The maximum induction of the investigated field must not exceed 100 mT. The device also includes a power supply with display, and a pointer-scale readout. Measurements can be made in stationary, high-frequency and pulsed fields in a range of 0-10 MHz. Induction range 0.01-0.1 T, sensitivity 10 V/(T/m), frequency band 0-10 MHz, maximum error ± 3 percent, output impedance 500 ohms, warmup time 10 minutes, distance between sensor and registration unit up to 30 m. Power consumption is 50 W or less from a 220 V line. The power supply measures 120 x 300 x 170 mm, and the probe is 20 mm in diameter and 60 mm long. Weight less than 3 kg. Figures 1.
[136-6610]

USSR

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THE "LENTA" FOUR-CHANNEL DIGITAL DEVICE FOR VIBRATION MEASUREMENTS

Moscow PRIBORY I TAKHNIKA EKSPERIMENTS in Russian No 6, Nov/Dec 79
p 188 manuscript received 10 Jul 78

GRINEV, V. G., KUREPIN, V. I. and GRINEVA, L. V.

[Abstract] This unit is designed for operation with piezoelectric acceleration sensors, and measures the values of vibration displacements, velocities and accelerations under laboratory conditions. The device contains four independent channels, each with two series-connected integrating units and a digital peak-to-peak voltmeter. The facility also includes a control unit, a data register, a code conversion module and a unit for matching to a PL-80 tape puncher. For piezoelectric sensors with sensitivity of $5 \text{ mV}/(\text{m} \cdot \text{s}^{-2})$, measurement ranges are 0.25-250 μm for displacements, 0.22-220 mm/s for velocities, and 0.2-200 m/s^2 for accelerations. Readout accuracy is 10^{-3} of the upper limit of the measurement range. Working frequency range is 10-500 Hz. The device is made with semiconductor components and series K140 and K155 microcircuits. Power consumption with keypunch operation is 180 VA or less. The unit operates from a 220 V line or a 27 V DC source. Figures 1.

AN INSTRUMENT FOR MEASURING MAGNETIC INDUCTION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian, No 2, Feb 80 pp 67-68

MISHARIN, V. V. and ANDREYEV, YU. A.

[Abstract] A teslameter has been built for measuring magnetic induction in the 0.0005-0.025 T range with a nonuniformity of the fields of ~ 1 percent at 1 cm. This instrument operates by the nuclear-magnetic-resonance method. It is based on nutation of the resultant nuclear magnetization vector in a stream of fluid, usually tap water, the amplitude of the nutation signal being determined by the probe and remaining independent of the measured magnetic field. The instrument consists of a polarizer with a steel magnet for the prepolarization of nuclei in the running water, a closed water circulation system including a pump and a tank, two nutation probes and one NMR probe, a receiver-preamplifier, a tuned amplifier, a modulator, and an oscillograph. The probes are all coils with 15 turns of copper wire wound on a glass tube for each, the nutation probes are held in the measured magnetic field (e.g., in the gap of a beta-spectrometer) and the NMR probe is held between the poles of the polarizer magnet. The amplifier is tuned to the second harmonic of the modulation signal, the frequency of the latter being 420 Hz, and its bandwidth is only 2 Hz so that any pickup will pass through. In operation with the second harmonic of the NMR signal there occurs automatic compensation of pickup from the modulating oscillator and the signal-to-noise ratio becomes much higher than actually recorded. The maximum error in determining the resonance frequency and thus also in measuring the magnetic induction is $3 \cdot 10^{-6}$. Figures 3; references: 4 Russian. [161-2415]

THE G77 MILLITESLAMETER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 186
manuscript received 15 Jun 78

KORSAKOV, V. V., SEMENOV, N. M., SKORODUMOV, S. A., SPIRIDONOV, V. N.
and FEDOROV, A. I.

[Abstract] The G77 milliteslameter is designed for measuring constant magnetic induction in the range of 0.05-1000 mT, and also the maximum and average values of alternating sine-wave magnetic induction and unipolar pulse induction in the range of 1-30 mT on frequencies of 50-500 Hz. Opamps amplify the output voltage of the sensing element when measuring

constant magnetic induction. A detector is used to isolate the amplified signal when alternating induction is measured. The sensing element is a Hall pickup. The output response of the pickup is linearized to within 0.5 percent in a range of 0-1000 mT. Measurement error for constant induction is ± 5 percent in the 1 mT range, and ± 2 percent in other ranges. The error is ± 4 percent for measurement of the average value of alternating induction, and $\pm 10\%$ for measurement of maximum values. Readout is by microammeter. There is an oscilloscope for observation for the waveshape of the measured signal. Four probes are provided: the G77-1 for measuring the tangential component of magnetic induction of the surface of specimens, the G77-2 for measuring the tangential component of magnetic induction on the inside of a specimen, the G77-3 for measuring magnetic induction in gaps, and the G77-4 for measuring the axial component of magnetic induction in solenoids. Cable length of each probe is 2.5 m or more. Working temperature range 10-35°C at relative humidity of up to 80 percent. Power consumption 30 VA at 220 or 36 V. Figures 1. [136-6610]

USSR

UDC 621.317.714.089.6:621.314.2

EXTENDING THE FREQUENCY RANGE OF AMMETERS WITH CURRENT TRANSFORMERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian, No 2, Feb 80 pp 44-46

SHVEDOV, V. A.

[Abstract] There are no instruments available for measuring currents higher than 1 A at frequencies above 30-50 MHz, at which the systematic error of existing standard and operational ammeters reaches 20-30 percent. This error is caused by the frequency dependence of the transfer ratio of current transformers used with these ammeters. Here the frequency characteristic of ammeters with current transformers is analysed, as a basis for extending the frequency range of these instruments. A long transmission line formed by the leakage inductance and the stray capacitance of the secondary winding of the transformer is assumed to connect the source of emf to the load impedance. For better accuracy, especially at low currents, the source of emf is distributed along that transmission line and the latter represented in the form of two symmetric (with respect to ground or the transformer housing) long lines with half the load impedance across each. Calculations based on the equivalent circuit diagram and voltage-current relations in it indicate that upper cutoff frequency can be lowered effectively by grounding any end of the secondary winding. The frequency range has also been extended in practice by shortening the transmission line as a result of distributing the load over the transformer winding, or by connecting a certain capacitance in parallel with the load. Experimental verification of the theoretical

results is difficult, except for indirect estimates in the low-frequency and the high-frequency ranges. Such a verification was made using a current transformer with a ferrite core. Figures 3; references 4: 3 Russian; 1 Western.
[161-2415]

USSR

UDC 621.317.757

METHODICAL ERROR OF A DISPERSION SPECTRUM ANALYZER - FOURIER TRANSFORMER

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 7, Jul 79
pp 11-13 manuscript received 1 Aug 78

POLYAKOV, P. F., Khar'kov Institute of Railway Transport Engineers imeni S. M. Kirov

[Abstract] An analysis is made of the methodical error of a Fourier transform made by a dispersion spectrum analyzer with a finite passband and finite dispersion of the analyzer's dispersion unit. The analysis error is caused by the finite electric length of the dispersion delay line. An expression is presented for the response of a dispersion spectrum analyzer with a specific transmission coefficient for the dispersion delay line. This expression takes into account the complex amplitude of the signal being analyzed and the midrange frequency, the delay at the midrange frequency, the dispersion and the passband of the dispersion delay line. This expression is converted to another form on the assumption of equality of the slope of the dispersion characteristic and the rate of linear change in the frequency of the local oscillator. It is demonstrated that a dispersion analyzer performs an ideal Fourier transform as the passband of the dispersion delay line approaches infinity only with an infinite passband. Such an instrument is not realizable and a real instrument has a methodical analysis error, i.e., an error in producing the transform. An estimate is made of this error in terms of its upper limit. It is demonstrated that a Fourier transform with a sufficiently low error can be performed by a dispersion spectrum analyzer whose passband is severalfold greater than the signal analysis band. The methodical error in performing the transform takes place on account of the formation of "tail-ends" of the converted signal in the delay line's input. It has been suggested that the passband of a dispersion delay line is equal to the sum of the effective width of the spectrum of the heterodyne signal and of the analysis band. A future study will be devoted to the creation of a Fourier transformer whose passband equals the analysis band. The paper was recommended by the Department (Kafedra) of Electrical Engineering and Electrical Measurements. Figures 1; references: 4 Russian.
[33-8831]

USSR

UDC 621.317.784.029:621.3.087.92

SENSITIVITY OF MICROWAVE-POWER WATTMETERS TO PARASITIC HARMONIC COMPONENTS OF THE SIGNAL

Moscow IZMERITEL'NAYA TEKHNIKA in Russian, No 2, Feb 80 pp 37-39

MYL'NIKOV, A. V., PEREPELKIN, V. A. and SHPAGIN, YU. V.

[Abstract] The sensitivity of three microwave-power wattmeters to parasitic harmonics in the signal was evaluated experimentally over their respective dynamic and frequency ranges covering the fundamental components as well as second and third harmonics. These wattmeters were the multi-sensor bolometric waveguide wattmeter (3.94-4.85-5.64 GHz, 0.3-10 W), the multisensor directional-coupler wattmeter with a thermistor bead (3.94-5.64 GHz, 0.1-50 W) and the 2-sensor ponderomotive wattmeter (4.75-5.25 GHz, 1-20 W). All three have intricately built sensing elements in their receiver-transducer stages. The frequency dependence of their reading error as well as their maximum sensitivity were measured with an instrument consisting of an oscillator, a power amplifier, a low-pass filter, a rectifier, a thermistor bridge, a thermistor bead, a directional coupler, a pyramidal transition, a transformer, the wattmeter, and a matched load. All three had been independently calibrated. The results indicate that the sensitivity of all three to parasitic harmonics can be higher than their sensitivity within the range of operating frequencies and thus contribute to the random measurement error inasmuch as it is resonant in nature. The bolometric wattmeter is least sensitive to parasitic harmonics and the additional error of the ponderomotive wattmeter can change sign. Figures 2; tables ; references: 2 Russian. [161-2415]

USSR

UDC 621.373.4

A DEVICE FOR MEASURING THE SPECTRAL DENSITY OF FREQUENCY FLUCTUATIONS OF PRECISION OSCILLATORS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 176
manuscript received 29 Jun 78

ASMOLOVSKIY, YU. A., MUKHIN, V. L., TOKAREV, V. V. and TAKHIN, V. SH.

[Abstract] This unit is designed for measuring the spectral density of frequency fluctuations of precision quartz-controlled oscillators and quantum frequency standards with nominal frequencies of 1 or 5 MHz. The device includes a Ch7-12 or Ch7-5 frequency comparator and a sequential-action spectrum analyzer with a set of frequency detectors.

Spectral analysis is done on an intermediate frequency of 8 kHz provided by an external tunable heterodyne, which may be a decade oscillator or a standard frequency generator. Three quartz frequency detectors cover a band of 100 Hz. Instability of frequencies of analyzed oscillators $\Delta f/f \cdot 10^{-9}$, range of frequencies of analysis 1-100 Hz, band of analysis 0.3, 10 Hz, heterodyne signal suppression 50 dB, integration time constant 1-4 s, set noises on analysis frequency of 1 Hz $(1.5-3) \cdot 10^{-13} \text{ Hz}^{-1}$, and on analysis frequency of 100 Hz $(1.1-1.5) \cdot 10^{-13} \text{ Hz}^{-1}$. Power supply from a 220 V line or batteries. Power consumption 28.2 W. Measurements 480 x 480 x 120 mm, weight 14 kg. Figures 1. [136-6610]

USSR

UDC 621.373.42

A MULTIPARAMETER SELF-EXCITED OSCILLATOR METER

Moscow PRIBORY I TAKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 179
manuscript received 18 Feb 78

ARSH, E. I., FLOROV, A. K., LEYZEROVICH, A. G., TVERDOSTUP, N. I. and KHANDETSKIY, V. S.

[Abstract] The instrument is designed for nondestructive inspection of heterogeneous materials such as rocks and ores, semiconductors, metallic polymers and so forth for small absolute values of conductivity and permeability. Operation is based on the change in amplitude and frequency of the rf voltage of a self-excited oscillator when the specimen is in the field of a sensor that is a component of the tank circuit. The installation contains four identical modules for four measurement channels, and a common power supply and display module. The first channel measures electromagnetic properties on a frequency of 0.88 MHz, the second channel measures susceptibility on a frequency of 125 kHz, and the third and fourth channels are used to study weakly conductive materials for an active component of inserted impedance on 13.56 MHz, and a reactive component on 5.28 MHz. The lower limit of measurable conductivity is 10^{-6} S/m , and susceptibilities can be measured in excess of $100 \cdot 10^{-6} \text{ SI}$ unit. Adjusted error is less than 2 percent. Specimens must have at least one flat surface with area of at least 100 x 100 mm and thickness greater than 70 mm. Power supply is from 16 type 373 cells or 220 VAC. Power consumption is less than 2 W. Dimensions of each measurement module are 150 x 150 x 110 mm, weight 0.4 kg. Power supply and display module -- 300 x 200 x 170 mm, weight 5 kg (with batteries). Figures 2. [136-6610]

A DEVICE FOR MEASURING THE PARAMETERS OF RANDOM PROCESSES

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
p 178 first version received 5 Oct 77; received 13 Jun 78

VASIL'YEV, V. A. and MARIYENGOF, I. B.

[Abstract] The instrument measures such parameters as the number of excursions, and the time that a process remains inside and outside of a predetermined interval between two arbitrary time functions. The unit contains controls for setting upper and lower threshold functions, a two-channel comparator, a time-pulse converter and a pulse peaking circuit. The device is based on a dual gated 521SA1 voltage comparator. Gating in each channel enables sampling of the random signals to be analyzed. The upper limit of the frequency spectrum of analyzable signals is 500 kHz, input signal amplitude 0-4 V, sensitivity ≤ 2 mV. The output is in the form of square pulses of fixed amplitude and duration in a number proportional to the number of excursions and to the time during which the voltage characterizing the random process has been inside or outside of a predetermined interval. The display is a PS02-4 single channel counter. Figures 1.

[136-6610]

A PULSE CHARGE METER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 181
manuscript received 3 Jul 78

ANTONEVICH, A. I., BUTSKIY, V. V., VETOKHIN, S. S. and SARZHEVSKIY, A. M.

[Abstract] The device measures the charges of pulses produced when scintillations activate a photomultiplier, including analysis and external display. The instrument includes a preamplifier, a main amplifier, an integrator, a linear acceptor circuit, a control unit, an integral-differential discriminator, an average count rate meter and a power supply. Output is displayed by a PDS-021 two-coordinate chart recorder, an electronic frequency meter, and an AI-256-6 multichannel analyzer. Charge measurement range is 10^{-13} - 10^{-6} C, duration of input signals is 2.5 μ s-10 ms, pulse recurrence rate 50- 10^5 Hz, passband 0-2 MHz, maximum signal amplitude at the output of the amplifier and integrator is 5 V, and gain ranges from 4.5 to 2000 in 450 stages. The integral-differential discriminator has 100 channels. Power consumption is 60 VA on 220 V. Measurements 516 x 456 x 136 mm, weight 14 kg. Figures 1.

[136-6610]

USSR

UDC 621.565.83:537.324

A LOW-CURRENT TWO-STAGE MICROCOOLER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
p 167 manuscript received 22 Mar 78

ANATYCHUK, L. I., MEL'NIK, A. P. and MIKITYUK, P. D.

[Abstract] A description of a microcooler intended for cooling photoresistors and for temperature stabilization of microcircuits. The unit is a two-stage thermopile with series connection of stages. The upper stage is a thermomodule made up of 18 half-cells measuring $0.4 \times 0.5 \times 2.5$ mm, and the lower stage is a separate thermomodule made up of 90 analogous half-cells. The microcooler occupies a volume of ≤ 0.25 cm³. Using a current of 0.3 A and power of 1.5 W, the device produces a drop in air temperature of 65-70 K. This drop can be increased by 15-18 K by filling the space around the cooler with xenon. Without heat sink, the unit weighs ≤ 1 g and measures $11 \times 5 \times 9$ mm. Figures 11.
[136-6610]

USSR

UDC 621.375.826

ASPECTS OF MODELING DIRECTIVITY PATTERNS OF CONFINED LASER BEAMS

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 7, Jul 79
pp 84-88 manuscript received 23 Nov 78

KUZ'MINA, T. I., Moscow Institute of Geodesy, Aerial Photography and
Cartography Engineers

[Abstract] In order to study the output characteristics of optical antennas, i.e., directivity patterns, in the far-range zone formed by the size of apertures used in transmitting energy over great distances, directivity patterns in the far-range zone are modeled in the laboratory in the focal plane of a lens, based on agreement between distributions of the field and intensity in the far-range zone and the focal plane. By employing a laser operating in the fundamental mode, steady distribution of intensity is achieved in the focal spot regardless of the relative position of the lens and the laser beam's constriction. An investigation is made here of the influence on formation of directivity patterns of the degree of confinement of the beam by the aperture and of the change in the radius of curvature of the laser beam's wave front in the plane of confinement. This problem is solved for the purpose of precisely defining the boundary between diffraction zones in the confinement of the laser beam, since the final result of the calculation depends to a great extent on the position of the plane of analysis in a specific diffraction zone. Another objective is the ability to determine tolerance values for the radius of curvature of the wave front in the confinement plane, which is of importance in designing optical systems forming a laser beam with specified diffraction divergence. It is assumed that the emission is strictly monochromatic, that an infinitely thin lens is used, and that the influence of the external environment on propagation of the emission is not taken into account. It is demonstrated theoretically that the distribution of intensity in the focal spot is more sensitive to a change in the radius of curvature of the wave front, the greater the degree of confinement of the beam by the diaphragm. Curves are shown, illustrating the distribution of intensity in the focal plane when a lens with a confining diaphragm is moved along the axis of the laser beam. Differences in distribution occur, which are caused by a change in the degree of confinement and the radius of curvature of the wave front of the laser beam. Data are presented which make it possible to determine values of the radius of curvature which are critical in terms of not changing the distribution in the focal plane of the lens. The general conclusion is drawn that in modeling the directivity pattern in the focal plane of a confining lens it is necessary to take into account the change in the boundary between the close-range and far-range zone. In designing optical systems which form beams with specific diffraction divergence, the change in this divergence must be taken into account, which is a

function of the radius of curvature in the plane of confinement. The paper was recommended by the Department (Kafedra) of Optoelectronic Devices. Figures 2; tables 2; references 4: 3 Russian; 1 Western. [33-8831]

USSR

UDC 621.373

A HIGH-VOLTAGE SQUARE PULSE GENERATOR

Moscow PRIBORY I TAKNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 101-103 manuscript received 14 Jun 78

BULATOV, M. U., TOROPOV, B. K., FILIPPOV, V. G. and CHERNOV, YE. N.

[Abstract] Generators based on shaping lines produce square pulses with tops that are quite flat. The best examples of such generators have two-stage shaping lines connected in series, each with its own commutating discharger. In this paper the authors describe a square pulse generator in which each two-stage shaping line is switched by multiple-gap dischargers with individual control of each discharger by a helical oscillator [see V. Ye. Zelenov, A. A. Perunov, USSR Patent No 600703, "Otkrytiya, izobreteniya, promyshlennyye obraztsy, tovarnyye znaki," No 12, 1978, p 232]. The generator uses 4 series-connected artificial 10-element two-stage shapers with wave impedance of 4 ohms apiece. The capacitance of each element of the shaping line is provided by an IK100-0.25U4 capacitor, and the inductance of 4.0 μ H is provided by a solenoid made of copper tubing 8 mm in diameter with 2 mm walls. The multiple-gap discharger consists of 17 electrodes, which are brass cylinders 18 mm in diameter with spherical ends and are spaced 8 mm apart. The trigger electrode passes through rings connected to each discharger electrode. The helical generator that triggers the discharger is made of interconnected copper strip lines. The dischargers have an operating range of 80 percent. Maximum voltage across the load is 320 kV, pulse duration is 20 μ s, current 10 kA, and the pulse top is flat within 1-2 percent. Figures 3; references: 7 Russian.
[136-6610]

USSR

UDC 621.373

A NANOSECOND PULSE GENERATOR

Moscow PRIBORY I TAKNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79 p 169
manuscript received 17 Apr 78

[Abstract] The generator utilizes the discharge of an external coaxial line charged from an external source of constant voltage. Discharge is through a KRM-6 contactor and the impedance of an external load. No warmup is needed. The unit includes the nanosecond pulse generator, a mandrel for winding the coaxial line, a synchronization tee, plugs for the coaxial line and for connecting the generator to channel, and a cable for connection to the external charging source. The duration of the output pulses is $2t = 0.2$ ns, where t is the electric length

of the external coaxial charging line, and the rise time of the pulse is 0.35 ns or less. Pulse recurrence rate is 150-300 Hz. Impedance of the external load is 50 ohms. Charging resistance of the generator is 52 kilohms, breakdown voltage of the contactor is 3 kV or more, the electric charge in a pulse is $8 \cdot 10^{-6}$ C, and the maximum momentary current on the load is at least 40 A. Guaranteed number of contactor operations--at least $2 \cdot 10^9$. Power consumption is less than 10 W at 200 V. Measurements 163 x 223 x 272 mm, weight 3 kg, approximate price 730 rubles.

Figures 1.
[136-6610]

USSR

UDC 621.373.52

A DISCRETE INFRALOW-FREQUENCY SINE-WAVE OSCILLATOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 97-99 manuscript received 27 Jan 78

SALOSIN, V. N., LEZHNEV, A. I. and KOSHEVOY, YU. V., Institute of Biological Physics, Academy of Sciences USSR, Moscow

[Abstract] An oscillator is described that generates a sinusoidal or sawtooth stepped output voltage with a period suitable for biological experiments (from 10^2 to 10^5 s). The generator consists of a master oscillator, a diode matrix and a code-to-voltage converter. The square pulses from the master oscillator are sent to a counter, and the output pulses of the counter flip-flops are sent to the diode matrix, which converts the parallel binary code of the counter to commands that control a discrete sine-wave voltage shaper. The counter is based on standard electronic equipment, and also contains a display based on AL102A LEDs. The unit has an error of ± 5 percent over the entire range of periods operation on a power supply of -12 V. The peak-to-peak amplitude of the sine-wave output is 4 V. Frequency-dependent feedback can be used to smooth out the waveshape into a continuous sine curve. Figures 2;

references 4: 3 Russian; 1 Western.

[136-6610]

A PULSE GENERATOR BASED ON A LAMBDA TRANSISTOR

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
pp 100-101 manuscript received 29 May 78

D'YAKONOV, V. P. and SEMENOVA, O. V., Smolensk Affiliate of Moscow Power Engineering Institute

[Abstract] Lambda diodes and their analogs are now widely used in making pulse circuits. Among the advantages of lambda diodes are no energy consumption in one of the states, wide range of voltages and currents, high input impedance, compatibility with the technology and voltage levels of monolithic microcircuits and so on. A disadvantage is that the current-voltage characteristic cannot be controlled. Lambda transistors do not have this disadvantage, and they can be used for making simple pulse devices of moderately high speed. This paper describes a lambda-transistor square-wave and sawtooth pulse generator based on complementary field-effect MOS structures. The device utilizes the effect of a change in the current-voltage characteristic of the lambda transistor when there is a change in the positive voltage across the gate of one of the component FETs. The output period can be varied over a range of 10^3 . Drift of the period is less than 2 percent for a temperature change from 20 to 100°C. Figures 1; references: 4 Russian.
[136-6610]

USSR

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EFFICIENCY OF A NUCLEAR ELECTRIC PLANT WITH DAILY LOAD RELIEF

Moscow ELEKTRICHESKIYE STANTSII in Russian No 1, 1980 pp 19-21

SAMSONOV, V. S., candidate of economic sciences, and KHAYMOV, G. M.,
engineer, VZPI-Soyuztekhenenergo [expansion not given]

[Abstract] An examination is made of the possibilities for reducing the total installed power of cycling and peaking generating facilities in regions where the cost of fossil fuel makes nuclear power competitive with condensation electric power plants. Analysis shows that nuclear power facilities can be operated in a schedule with daily load relief during nighttime hours with greater efficiency than attained in the same schedule with condensation electric power plants. In regions where fossil fuel is expensive, it may be economically feasible to construct nuclear power plants even where the increase in nuclear power necessitates load relief at night. Factors that limit the installed nuclear power are the cycling capabilities of the generating plants, and also the number and depth of permissible relief cycles. If provisions are made for two-step load schedules when designing nuclear power facilities, it may be possible to increase the efficiency of power generating equipment, and to reduce the requirements for cycling and peaking generating facilities. Further research is needed to determine the permissible depth of load relief and the permissible number of cycles in two-step load scheduling for nuclear electric plants. Figures 1; references: 5 Russian.
[163-6610]

USSR

UDC 621.315.1.027.857:621.317.328

MEASUREMENTS OF ELECTRIC FIELD STRENGTH UNDER A 750 kV POWER TRANSMISSION
LINE IN AN ORCHARD

Moscow ELEKTRICHESKIYE STANTSII in Russian No 1, 1980 pp 55-56

ALEKSANDROV, G. N., doctor of technical sciences, KASHINA, V. A., engineer,
LISOCHKINA, T. V., candidate of economic sciences, and PODPORKIN, G. V.,
candidate of technical sciences, Leningrad Polytechnical Institute imeni
M. I. Kalinin

[Abstract] One technique for ecological protection from the effects of overhead high-voltage transmission lines is to use the shielding provided by vegetation. This paper gives the results of measurements of the electric field in an apple orchard beneath a 750 kV power transmission line. The average height of the trees is 4-5 m, diameter of the crown

is 5-7 m, and the distance between trees is 8 m. The measurements were made with the PZ-1 field strength meter at a level of 1.8 m above the ground at an air temperature of 20°C. The distance from the ground to the overhead power lines at the point of measurement was 17.7 m. The maximum field strength was observed in the middle of the rows between trees, and was measured at 3 kV/m. Under the same conditions, but without overhead vegetation, the field strength under this line was 10 kV/m. Figures 2; references: 2 Russian.
[163-6610]

USSR

UDC 621.311.014.38(049.3)

COORDINATION AND OPTIMIZATION OF SHORT-CIRCUIT CURRENT LEVELS IN ELECTRIC SYSTEMS

Moscow ELEKTRICHESTVO in Russian No 2, Feb 80 p 72

SIVOKOBYLENKO, V. F., candidate of technical sciences

[Review of the book "Koordinatsiya i optimizatsiya urovney tokov korotkogo zamykaniya v elektricheskikh sistemakh" by B. N. Neklepayev, Moscow, "Energiya," 1978, 152 pages]

[Abstract] The book deals with the most important aspects of the problem of limiting short-circuit currents, coordinating and optimizing the levels of these currents in various kinds of power grids. The first chapter, based on statistical data for 90 power systems of the USSR, presents the maximum values of short-circuit currents and powers in 35-500 kV grids, the pattern of change in these parameters from 1962 to 1975, and the major factors that determine the maximum levels of short-circuit currents in complex power grids. It is pointed out that quite a number of systems have short-circuits exceeding the permissible values for switching equipment, which has an adverse effect on reliability. The second and third chapters examine requirements for equipment. Tentative recommendations are given for breakers, disconnectors and current transformers. Recommended short-circuit currents are: 50 kA on 110 kV, 63 kA on 220 kV, 80 kA on 330-500 kV, 100 kA on 750-1150 kV. Different methods and means of limiting short-circuit currents are considered in the fourth chapter. The fifth chapter deals with optimization of short-circuit current levels in electric generating plants and power grids, the sixth chapter takes up methods of predicting short-circuit current levels, and the seventh chapter examines coordination of short-circuit current levels and equipment parameters.
[160-6610]

USSR

UDC 621.378.33

THE LG-75-1 HELIUM-NEON LASER

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 6, Nov/Dec 79
p 185 manuscript received 17 Jul 78

KOLTUN, V. L., KRAVETS, M. V. and SENYUKOV, A. I.

[Abstract] A description of the LG-75-1 multimode cw He-Ne laser with output power of 25 mW on a wavelength of 0.63 μ m. The device is designed for a work life of 5000 hours. The laser is reliable, resistant to mechanical and climatic factors and easy to use. The installation includes an emitter and a power supply. The emitter is designed for easy replacement of a failed active element. An aligning unit is provided for readjustment of the cavity where necessary. The shelf life of the device is 5 years. Vibration resistance is 10-80 Hz at 12 g, ambient working temperature from -10 to +40°C. The laser can be transported at ambient air temperatures from -50 to +70°C. The emitter measures 103 x 114 x 1095 mm, weight 10 kg. The power supply measures 650 x 440 x 171 mm and weighs 19 kg. Price (with emitter and power supply) 1065 rubles. Figures 1.
[136-6610]

USSR

UDC 621.315.59

CALCULATION BY PROBABILITY METHODS OF SWITCHING-OFF PROCESSES OF HIGH-VOLTAGE SEMICONDUCTOR COMMUTATORS

Leningrad IZV.VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 7, Jul 79
pp 47-51 manuscript received 1 Sep 78

GLAZENKO, T. A. and BUDILOV, B. A., Leningrad Institute of Precision Mechanics and Optics

[Abstract] High-voltage semiconductor commutators based on series-connected thyristors (PST's) are important components for powering lasers, for example. Often after triggering, a reverse voltage is applied to commutators and because of the deviation in the electrophysical parameters of thyristors this voltage is divided unevenly among them. This leads to overvoltages in PST's and results in their breakdown. RC damping networks connected in parallel with each thyristor are employed for the purpose of equalizing return voltages between PST's. Here a probabilistic analysis is made of the distribution of the steady-state return voltage over PST's recovering their cutoff ability and shunted by RC networks, as a function of the distribution of the lifetime of minority charge carriers (holes) in wide n-bases of PST's and of the value of the capacitance of capacitors in the voltage-dividing RC networks. The lifetime of holes, τ_r , in n-bases of PST's is mathematically considered as a random value having a definite law of distribution, and the division of the steady-state return voltage by PST's shunted by RC networks is regarded as a random process. For the purpose of determining the law of distribution of τ_r and for constructing a statistical series, a measurement was made of the lifetime of holes in wide n-bases of 50 type T150 thyristors. As a result of processing the experimental data, it was determined that the statistical distribution of random values of τ_r can be approximated by a normal law of distribution with a mathematical expectation of $m_{\tau_r} = 14.39 \mu s$ and a root-mean-square deviation of $\sigma_{\tau_r} = 4.44 \mu s$. A histogram and a smoothing curve are given for the normal law of distribution of the lifetime of holes. The return overvoltages in PST's being switched off depend on the distribution of current between the thyristors and RC damping networks. When PST's are being cut off, the return voltage in the thyristors is made up of the voltage drop in the resistors and the voltage in the capacitors. The voltage drop in the resistors is decisive at the initial stage, but as the thyristors cut off, the current through them and through the damping RC networks is reduced and the voltage in the capacitors becomes decisive. The capacitance of the capacitors of the RC damping networks determines the distribution of the steady-state return voltage over PST's being shut off. A model is presented for analysis. An equation is derived for the probability of the fact that the reverse voltage in any thyristor in a series of PST's will not exceed the permissible value. This equation is applied for the purpose of calculating the capacitance of capacitors

of RC networks in the voltage-dividing circuit when type T150 thyristors are employed. The paper was recommended by the Department (Kafedra) of Electrical Engineering. Figures 2; references: 3 Russian.
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